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PASTEUR

HE BECAME THE WORLD'S GREATEST BENEFactor BY HIS DISCOVERIES IN
CHEMISTRY AND BIOLOGY. HE REVOLUTIONIZED MEDICINE AND
SURGERY, MAKING ALL HUMANITY HIS DEBTOR.

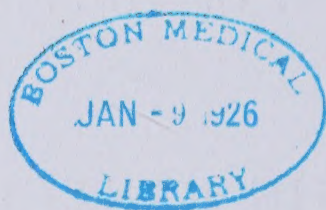


NATIONAL CELEBRATION
OF THE
CENTENARY OF THE BIRTH OF
LOUIS PASTEUR

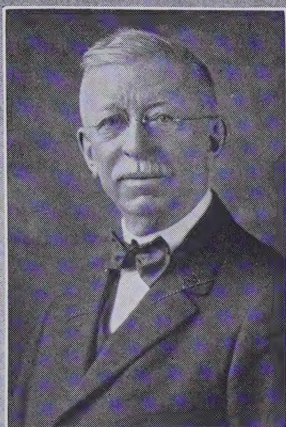
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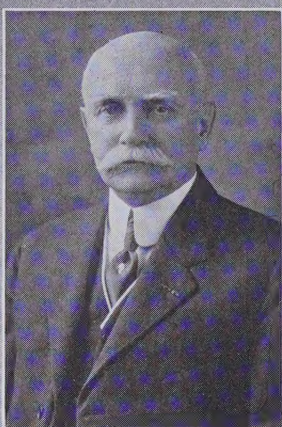
Philadelphia, Pa., December 27, 1922



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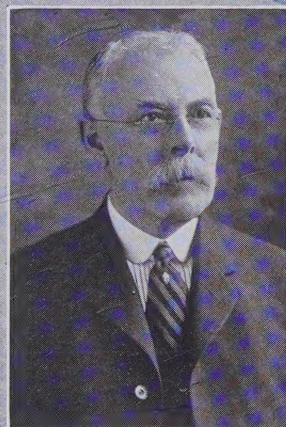
DR. EDGAR FAHS SMITH



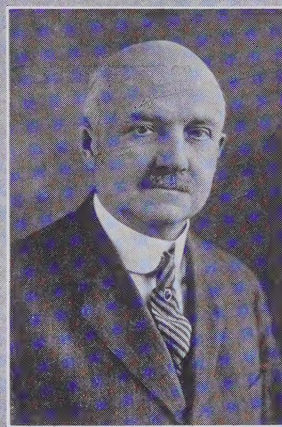
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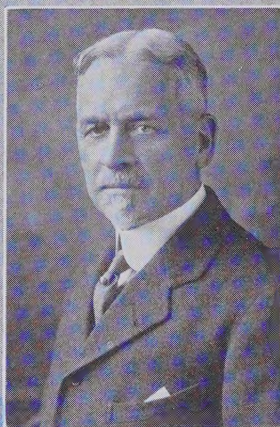
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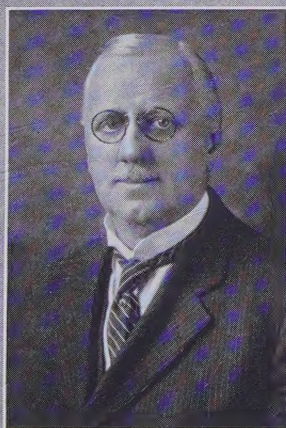
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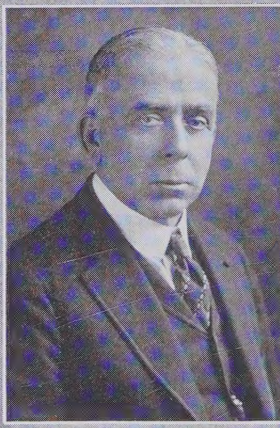
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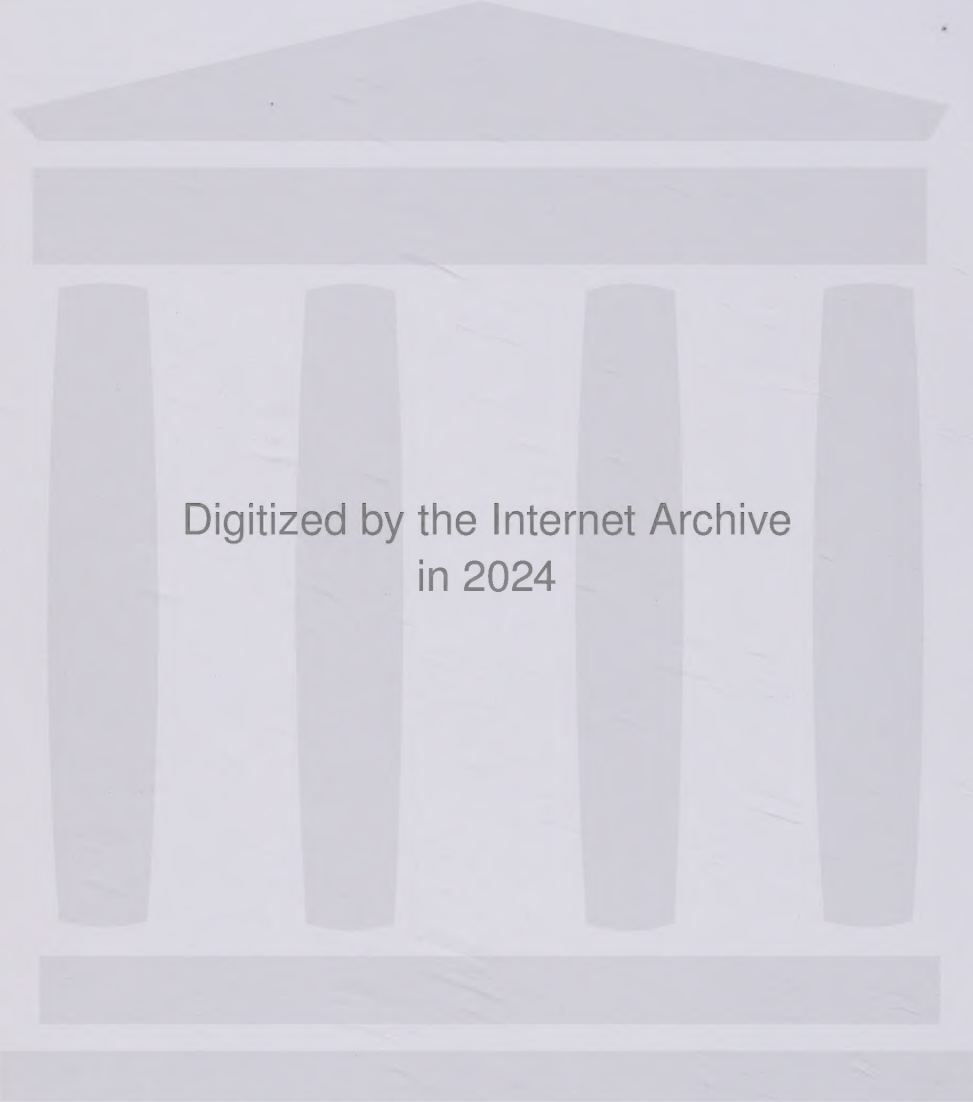


DR. EARNEST LAPLACE

GENERAL COMMITTEE

NATIONAL PASTEUR

CENTENARY CELEBRATION



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FOREWORD

The fact that December 27th, 1922, would mark the 100th anniversary of the birth of Louis Pasteur gave rise in the spring of that year to the sentiment that the occasion should be fittingly celebrated in America, that the celebration should be national in its character, and further that it should be held in Philadelphia. A general committee was formed under the presidency of Dr. William Duffield Robinson, together with a large National Advisory Committee consisting of physicians, chemists, biologists and other scientists representing various sections of the country.

On December 27th, 1922, two sessions were held, one in the afternoon at the Academy of Music, Philadelphia, upon which occasion a number of eminent scientists made addresses, Dr. Edgar Fahs Smith, former Provost of the University of Pennsylvania, presiding. The occasion was especially graced by an address by the Ambassador of the French Republic, M. Jules Jusserand, and by messages from the President of the United States, Warren G. Harding, from Chief Justice of the Supreme Court, William H. Taft, and from former President, Woodrow Wilson. Messages were also received from Sir Auckland Geddes, the British Ambassador to the United States, from M. Roux and M. Calmette, of the Pasteur Institute of Paris, and from Dr. Pasteur Vallery-Radot.

In the evening a dinner was held at the Bellevue-Stratford Hotel, Philadelphia, Dr. Ernest LaPlace presiding, at which 450 guests were present. Eloquent addresses were made by distinguished men from various parts of the country, including one by the special delegate of the French Republic to the celebration, M. Etienne Burnet.

PRESIDING OFFICER
DR. EDGAR FAHS SMITH

Former Provost, University of Pennsylvania
President of the American Chemical Society

ADDRESSES

1. DR. RUSSELL H. CHITTENDEN, LL.D.

Professor of Physiological Chemistry, Sheffield Scientific School,
Yale University, New Haven, Conn.

"Pasteur in Chemistry"

2. DR. VERNON KELLOGG, LL.D.

Chairman, National Research Council, Washington, D. C.

"Pasteur and Biology"

3. DR. JOHN B. DEAVER, Sc.D., LL.D.

Professor Emeritus of Surgery, University of Pennsylvania.

"Modern Surgery's Debt to Pasteur"

4. DR. HUGH S. CUMMING,

Surgeon-General, Bureau of Public Health Service, Washington, D. C.

"Pasteur's Influence on Public Health"

5. M. JULES JUSSERAND, LL.D.

Ambassador of the French Republic, Washington, D. C.

"Pasteur as a Man among Men"

On account of their great interest in this celebration—

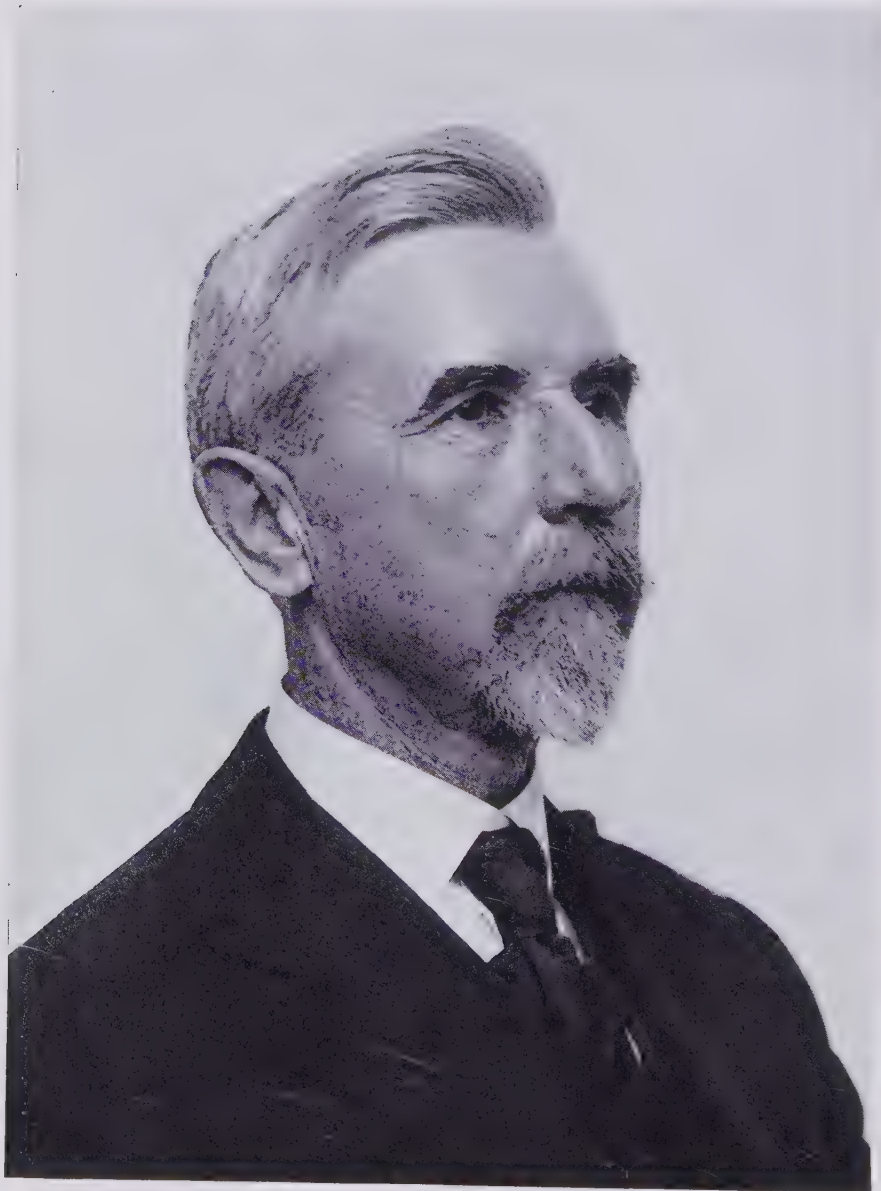
WARREN G. HARDING, President of the United States,

WM. HOWARD TAFT, Chief Justice of the United States, and former
President of the United States, and

WOODROW WILSON, former President of the United States,

sent communications which were read by the Presiding Officer, DR. EDGAR FAHS SMITH.

Through the courtesy of Mr. Leonard H. Kinnard, President of the Bell Telephone Company of Pennsylvania, and of Mr. A. W. Lincoln, of the Bell Telephone Company of Pa., and Mr. Gordon Harper Cilley, of the Wanamaker Radio Broadcasting Station, all the exercises of the afternoon were broadcasted throughout the United States.



DR. RUSSELL H. CHITTENDEN, LL.D.

THE PRESIDING OFFICER: We have come together this afternoon to think and speak of Louis Pasteur, who gained the honors of the whole world, while his character won affection and reverence from all. His name rises before us, inscribed, not with ink upon parchment, but in "letters of living light" upon our hearts.

Having, with absolute self-abnegation, laid epochmaking discoveries in pure science, in vital industries and in medicine at the feet of humanity,

He gave his honors to the world again,

His blessed parts to Heaven, and slept in peace.

Turning the pages of his life-story one encounters a chapter entitled "Pasteur in Chemistry." Here let us pause and harken to the words of him whose own illuminating and pioneer studies justly entitle him to speak in this august presence—Dr. Chittenden.

Address of Dr. Russell H. Chittenden, LL.D.

Professor of Physiological Chemistry, Sheffield Scientific School,
Yale University, New Haven, Conn

"PASTEUR IN CHEMISTRY"

Mr. Chairman, Mr. Ambassador, Ladies and Gentlemen:

In the words of Rénan, the scientific work of Pasteur "is like a luminous trail in the great night of the infinitely little, in those ultimate abysses of being where life is born."

With a mind endowed with keenness of vision rarely surpassed, with a fertile imagination continually giving birth to theories and hypotheses of startling significance, but always restrained by a calm judgment which demanded a sound basis of experimental facts, Pasteur made so many brilliant discoveries of the highest scientific value and of the greatest benefit to mankind, that one may well hesitate to specify relative values. Yet as a chemist I am inclined to think that his chemical training and experience had much to do in fitting him to control properly the scientific machinery which he so well knew how to set in motion.

Pasteur was primarily an experimentalist. His life was spent mainly in the laboratory with his polariscope, microscope, test tubes and flasks. Every theory, every suggestion his fertile imagination gave birth to was most carefully criticized by all possible experimental methods in an effort to ascertain the truth. He rarely went astray, so exhaustive were the means he devised to judge his theories, with the result that his conclusions have endured the test of time.

As a young lad, studying at the local college near his home, he began to manifest a growing interest in science, chemistry especially appealing to him. So great did his interest in the subject become that he obtained private help from a local chemist to assist him in his studies and experiments and to help him make ready for the examinations of the Ecole Normale of Paris.

Now that he was ready for the more advanced study of this institution and had likewise the privilege of attendance at the Sorbonne, he had before him all the advantages of instruction from the renowned masters at the French capital. Here he had association with the great Dumas and Balard and the younger man, Delafosse. His studies were mainly chemistry, physics and mathematics, and his life work, as he had then decided, was to be in chemistry. It was the fall of 1843 and he was twenty-one years of age. His energy and enthusiasm for work grew by leaps and bounds and his love for chemistry was rapidly becoming a passion. The days were not long enough to

give time for the many experiments he desired to work through. It is related of him that being curious as to the best method of preparing phosphorus, he purchased a large quantity of bones from a butcher and then spent a holiday in the laboratory from 4 o'clock in the morning until 9 o'clock at night working over the material until he finally succeeded in obtaining more than two ounces of phosphorus.

Pasteur's progress was rapid and soon he was in the position of assistant to Balard of the Ecole Normale and on the threshold of his scientific career. In 1846 this progress was threatened by the desire of the Minister of Public Instruction to have him teach Physics at the Tournon Lycée. His chief, Balard, however, interfered, writing to the Minister that "it would be rank folly to send five hundred kilometers from Paris a youth who only asked for the modest title of curator and had no ambition but to work from morning until night, preparing for his doctor's degree. There would be time to send him away later on."

Pasteur's thesis on chemistry was entitled "Researches into the Saturation Capacity of Arsenious Acid; A Study of the Arsenites of Potash, Soda and Ammonia," while his essay on physics was a "Study of Phenomena relative to the Polarization of Liquids." Pasteur, though proud to see his work published and recognizing that he was making headway, clearly understood that all he had accomplished in chemistry was, after all, "only schoolboy work," as he expressed it, adding that he had not yet enough practice and experience in laboratory work. He was, however, rapidly reaching the point in his career where his work leading to the discovery of the molecular dissymmetry of tartaric acid was to attract the attention of the scientific world.

Through his companionship with Delafosse, the young professor of mineralogy, he had become much interested in the science of crystallography and he spent considerable time in the careful study of various crystalline forms, measuring the angles of crystals, etc., but with special reference to their rotation of the plane of a ray of polarized light. It was known at that time that there were two forms of quartz, one rotating the plane of polarization to the right, the other to the left; yet, in spite of this marked difference in behavior to polarized light, they have the same crystalline form, each of them in quartz. The only visible difference between them is that there are certain minute faces on these crystals, some having these faces on the right side, others on the left side of the crystals.

Dating back to 1815, Biot in his careful studies on the phenomena of polarization had called attention to the fact that there were many organic substances occurring in nature, both crystalline and amorphous, which possess the power of rotating the plane of polarized light, some to the left and some to the right. Further it is noted that, whereas with quartz the rotation is conditioned by the crystalline form, disappearing at once as soon as the form is destroyed, in the case of these organic substances the rotation is not bound up with the form, but is manifested only in solution and presumably, therefore, is dependent upon the molecules themselves. As expressed by Frankland, "this discovery of Biot's had thus placed the physical phenomena of polarization on the doorstep of the chemist." It was in the year 1844 that the German chemist Mitscherlich announced his discovery that the two tartaric acids, so well known to chemists, apparently identical in all respects, behaved differently toward polarized light, the solution of one turning the plane of polarization to the right while the solution of the other, known as paratartaric or racemic acid, was without action on polarized light. In announcing this discovery Mitscherlich added this statement:

"The nature and number of atoms in these two bodies, as well as their arrangement and the distances between them, are identical."

This statement attracted the attention of Pasteur and caused him to reflect upon the matter. It evidently seemed to him that this reasoning was entirely unjustified.

"How," said Pasteur, "can we accept the identity in the nature and number of atoms, admit that the relative distance and arrangement and the crystalline form are the same in these two bodies, without admitting also their absolute and entire identity throughout? A profound incompatibility surely exists between Mitscherlich's discovery of the different relationship of these two tartrates toward polarized light and his statements that they are identical in every particular."

Pasteur immediately turned his attention to a microscopic study of the crystals of tartaric acid; the ordinary commercial acid and the rarer racemic acid. He soon discovered what had hitherto escaped notice, that on the crystals of the commercial acid, and of the tartrates, there was a minute face, so placed that he was confident that these crystals were dissymmetric, one of a pair of forms, and that somewhere in nature there must exist the other form, with a face so placed "that the two forms together would make up the complete plan of tartaric acid. He was in quest of a left-hand tartaric acid, which science had never seen, nor dreamed of seeing. He could only guess that it might somehow be locked up in racemic acid." (Paget) After long and diligent search he entered on the road that led to success. He made a double salt of the racemic or paratartronic acid, sodium-ammonium tartrate, crystallized it and examined the crystals under the microscope. To his great joy he found two distinct forms, one form showing the facet of the commercial acid, while the other form had a facet proper to the unknown acid. Pasteur then sorted these crystals carefully into two groups, those having faces inclined to the right in one group, and those with faces inclined to the left in another group. Then preparing solutions of the crystals from each group and testing them with the polariscope, the far-reaching discovery was made. The one form of crystals rotated the plane of polarized light to the right, the other to the left in equal degree. The mystery of racemic acid was revealed; the acid was simply a combination in equal amounts of two opposed forms. Racemic acid naturally has no action on polarized light, since it is composed of a right-handed tartaric acid in every way identical with the natural tartaric acid of the grape and a left-handed tartaric acid, the two together exactly neutralizing each other so far as action on polarized light is concerned.

Think what this discovery meant. Its significance reached far beyond tartaric acid. As stated by Professor Frankland in his life of Pasteur:

"For more than thirty years Biot, who was the first to discover the behavior of organic chemical substances toward polarized light, had urged that polarimetric study of these substances might possibly prove an important avenue to the understanding of their constitution, but although he had led scientific thought, and directed experimental activity with marvelous instinct in the direction of that new realm of chemistry, so fraught with fascination and absorbing interest to the investigator, it was not given to Biot himself to cross the frontier, but this advance was reserved for Pasteur."

Pasteur's discovery, with the theory which it leads to, namely, that molecular dissymmetry is the result of a certain grouping of the atoms within the molecule, marks the beginning of stereo-chemistry; the two forms of tartaric acid must have a different arrangement of their constituent atoms. It was in 1874 that Van't Hoff developed his theories regarding stereo-chemistry, one of the most fertile fields of modern chemical science. Our present-day understanding of the constitution of carbon compounds, the spacial arrangement of the atoms within the molecule, both of compounds with action on polarized light and innumerable compounds without such action, is the direct outcome of these early and fundamental researches of Pasteur. The wonderful achievements of chemists like Emil Fischer, Ladenburg and others in building up synthetically such important organic compounds as the sugars and the alkaloid conine are striking illustrations of what this theory has led to.

To quote Professor Frankland again:

"By these first researches we see, then, that Pasteur became the father of one of the most wonderful departments of modern chemistry—namely the one which has for its ambition the discovery of the spacial distribution of the individual atoms in the molecule. Thus, Pasteur's first researches possessed in themselves purely theoretical interest; they were, however, masterpieces of thoroughness and exhibited so much experimental skill, intuition and power of careful observation, combined with clear judgment, that even had his career been cut short at this stage, we should have no hesitation in recognizing in him one of the most remarkable and exceptionally gifted of investigators."

Pasteur, in a measure at least, foresaw the possibilities of his important discovery. He prepared a paper for the Academy of Sciences which the celebrated Biot sponsored, entitled "Researches on the relations which may exist between crystalline form, chemical composition, and the direction of rotatory power."

It is interesting to note in passing how the scientific world of Paris looked at Pasteur's researches when they were first announced. He was a young man, only twenty-five years of age, just starting on his career and was practically an unknown quantity to the older Academicians. Vallery-Radot in his interesting life of Pasteur refers to this very point in the following words:

"In Paris, in the scientific world perhaps even more than in any other, everything gets known, repeated, discussed. Pasteur's researches were becoming a subject of conversation. Balard, with his strident voice, spoke of them in the library at the Institute, which is a sort of drawingroom for talkative old Academicians. J. B. Dumas listened gravely; Biot, old Biot, then seventy-four years old, questioned the story with some skepticism. 'Are you quite sure?' he would ask, his head a little on one side, his words slow and slightly ironical. He could hardly believe, on first hearing Balard, that a new doctor, fresh from the Ecole Normale, should have overcome a difficulty which had proved too much for Mitscherlich. * * * * 'I should like to investigate that young man's results.'"

And investigate them he did with the cordial co-operation of Pasteur, and when the final result was obtained and he witnessed for himself the action on polarized light of the two forms of tartaric acid, the dextro- and levo-rotary, he took Pasteur by the arm and said, "My dear boy, I have loved Science so much during my life, that this touches my very heart."

The standing of Pasteur as a man of science was rapidly gaining recognition, not only at Paris but among his countrymen throughout the empire. The Government, much to his regret, sent him to Dijon as Professor of Physics; a place where he could not well continue his researches, but where his time was wholly occupied in routine teaching. This, however, did not last long, for soon he had a call to Strasbourg as Professor of Chemistry and at the opening of the year 1849 he was installed there under congenial conditions where he could continue his active work on racemic acid. His search for this acid illustrates his vigor and perseverance under difficulties. He traveled about through the various factories where crude tartar was refined and pure tartaric acid was manufactured. He had indeed found that racemic acid was occasionally present in samples of tartaric acid from various countries, but its presence was seemingly an accident and apparently no one knew how to prepare it. He visited Vienna, Prague, Leipzig, Freiburg, and other places where chemical industries were being carried on, but without success. He came to the conclusion that so far no chemist had ever made pure racemic acid from pure tartaric acid, but he was convinced that such a conversion was a possibility, or at least that in some way pure racemic acid could be produced.

He set himself to this task and finally after many trials he succeeded by simply exposing cinchonine tartrate to a high temperature for several hours. This was in 1853. In view of the work he was to undertake later, it seems almost miraculous the way his researches had shaped themselves, paving the way, as it were, for what was to come later. He had spent his energy in studying molecular dissymmetry from a purely scientific motive. He had selected tartaric acid for special study from a similar motive.

In the words of Paget "he had chosen—as it were at random—a grape acid, an article of commerce, a product of fermentation; his quest of racemic acid had compelled him to see with his own eyes the whole business of the making of wines, had carried him from crystals to ferments, from experimental physics to one of the world's most colossal industries. He has recorded how, at this time, he discovered that a racemate, in the presence of the ferment, is split up; that the ferment picks out the right-handed acid and leaves the left-handed acid. Here, over this one observation, we seem to be standing on the very border between the two kingdoms, between 'pure science' and 'applied science.' Only his genius inspired him not to lower science to the level of trade, but to exalt trade to the level of science."

The way for Pasteur's future work was made easier by his appointment as Professor and Dean of the Faculty of Sciences at the University of Lille in the year 1854. In the very center of a great industrial region he was brought closely in touch with the manufacture of alcohol from beets and grain, so that the study of fermentation naturally attracted him. At that date, it is well to remember, fermentation and putrefaction as well were looked upon, following the views of Berzelius and of Liebig, as the result of catalytic force and influence. It was not a vital process, but was due, in the case of fermentation, to the dead yeast undergoing decomposition, the disturbed equilibrium being communicated to the elements of the substances in contact and thus the sugar broken down into alcohol and carbon dioxide.

The position occupied by Liebig in the world of science, naturally gave great weight to his opinions and the determined opposition he had always manifested toward any vitalistic theory of fermentation had prevented the spreading of views pointing in that direction. Thus, the studies of Latour in 1837 led him to believe that there was some connection between the life of the yeast cells and the process of fermentation. Schwann, likewise, observed the budding of yeast cells and showed that there was some relationship between the extent of fermentation and the multiplication of the cells, but Helmholtz in 1843, while confirming what Schwann had observed, namely, that both fermentation and putrefaction were checked when the mixtures were boiled and they were allowed to come only in contact with heated air, could not find any evidence of germ life in putrid fluids. He concluded that, so far as fermentation was concerned, the presence of cells or germs was purely a matter of secondary importance and not connected in any direct way with the breaking down of sugar into alcohol. These statements will suffice to illustrate the conflicting views more or less prevalent regarding fermentation, when Pasteur began his work on the subject; work that covered a period of twenty years, with discoveries, the consequences of which were to revolutionize certain aspects of chemistry.

Pasteur, with his chemical training and his chemical intuition, could not see any tangible reason for belief in the view of transmissibility and continuation of the processes of fermentation or putrefaction from one material to another. What sets the process in motion and what controls its continuance? With infinite patience he set to work and in the many years of labor devoted to this subject he added fact after fact to the sum of knowledge, showing clearly that alcoholic fermentation is correlated to the life and organization of the yeast cells and not to their death or putrefaction. The amount of experimental material he gathered during these years of work was enormous,

but equally astonishing was his ability to see things which his predecessors had failed to observe. Thus he discovered both glycerine and succinic acid as constant products in the fermentation of sugar.

As his work continued, the vitalistic theory of fermentation became firmly established and the phrase, "no fermentation without organisms; in every fermentation a particular organism," was thoroughly justified.

One can imagine the enthusiasm and delight of Pasteur could he have witnessed the results of Buchner's work in 1897, when he extracted from the yeast cell the actual ferment, zymase, which is the direct cause of alcoholic fermentation. This completes the story and introduces us to new exercises of theory in chemistry. The old-time dispute between Liebig and Pasteur ends; the formation of zymase in the yeast cell may be expressed in terms of plant physiology, while the action of zymase may be stated in terms of molecular physics.

It was to Pasteur a great joy that his discoveries in fermentation opened up new ways by which the industries of his country could be safeguarded and improved. These industries were to him naturally "the hunting ground of science" and it was a great satisfaction to realize that his work in this field was enabling his countrymen to improve the beverages of the country, to cure the diseases of wines, to speed up fermenting vinegar, to manufacture alcohol out of beet sugar, to understand and control lactic acid fermentation; but these were merely incidents during his twenty years study of fermentation, in the larger effort to prove what he had come to see was a fundamental and far-reaching scientific truth, namely, that the processes of fermentation in general, the processes of decomposition and putrefaction, are chemical changes due to the living dust of the air. It was a startling thesis to maintain in the year 1864 that all these processes are due to living organisms, yeasts, and bacteria, present in the fermenting grape juice, sour milk, hay infusions or meat broth; that if these microscopic points of life are filtered out of the air, no liquid, whatever its nature, will ferment in air so sterilized.

Remember that all these processes of fermentation and putrefaction occur through the intermediary of cellular secretions, through physico-chemical agencies, that in putrefaction the toxic actions are the result of chemical products—toxins—an old story to-day, but in 1864 startling in its novelty and in its suggestiveness. Skepticism was rife, new ideas take root slowly, and for a long period Pasteur's work and his views were subject to much criticism. Physicians were inclined to belittle him and to decry a chemist encroaching on the field of medicine. As Duclaux writes in his book on Pasteur, "The physicians were right in treating him as a chemist. They were wrong only in pronouncing his name with a disdainful air."

Pasteur was primarily a chemist and it was as a chemist that he opened the gates to paths which eventually led to new and wonderful conceptions in the science and art of medicine.

Pasteur's work in these earlier years of his life yielded results of great value for advance of knowledge in chemistry and biology, still more for increase of knowledge in that border land between physiology and chemistry known as bio-chemistry, yet perhaps the greatest value lies in the broad chemical training these years of work provided as fitting him for successful mastery of the many problems still awaiting him. For it is a singular thing that "to change the whole outlook of medicine and surgery, Heaven took and trained a pure scientist, who had never done an operation nor written a prescription; * * * took this non-medical man of science and set him to be the head of all the heads of the medical profession, to have them all obedient to his teaching and proud of the very sound of his beloved name."

Pasteur, "a conqueror, whose glory is as incalculable as the good he has accomplished."



DR. VERNON KELLOGG, LL.D.

THE PRESIDING OFFICER: The great master wrought marvels in the elucidation of the functions of the lower forms of vegetable and animal life, so that the chapter "Pasteur and Biology," will find its truest interpreter in one who has walked in the footsteps of the inspiring teacher and whose sympathies for life in its humblest and most varied forms have encompassed the globe—Dr. Vernon Kellogg.

Address of Dr. Vernon Kellogg, LL.D.

Chairman, National Research Council, Washington, D. C.

PASTEUR AND BIOLOGY

Several years ago I heard, in Paris, a remarkable play. It was a play written by Sascha Guitry, a popular and versatile Paris playwright, and the title-role, or hero's part, was played by the dramatist's father, Lucien Guitry, the greatest living actor in France, which is, in effect, to say the greatest living actor in the world.

This play made a vivid impression on me not alone because it was unusual in having no love motive nor any crime mystery, nor even any complex and suspense-enhancing plot, and was yet of fascinating interest, but for other reasons as well. It unfolded a simple although highly dramatic biographical story of its hero. This hero was of an unusual type. At the time of the play's appearance the French heroes holding the attention of the French public were those of war and statecraft. But the hero of this play was not a military or political hero. He was a French hero of science, whose life had closed nearly a hundred years ago. The scenes in the play presented him as lecturing to a few students, as working in a scientific laboratory where he potted about with microscope and test-tubes, and as coming in to a great meeting of scientific and literary men and official dignitaries on the arm of the President of the Republic.

No one of these scenes could be made to be particularly thrilling, you would say, yet every one thrilled me and obviously thrilled the whole audience. One especially appealing scene represented the hero leading into the laboratory a little boy who was bandaged on face and arms. This boy actor represented Joseph Meister, the forever famous Alsatian lad, badly bitten by a mad dog, who was the first human being on whom an anti-toxin inoculation against rabies, or hydrophobia, was made. The name of the hero of the play, and the name of the play, was Pasteur. The play was a great success and ran for a long time.

The production and reception of this play in Paris impressed on me what many other things have similarly impressed on me, which is, that France recognizes to a degree equaled perhaps by no other nation the high importance in human life of the things of the mind, the things of art and literature and philosophy and science. And she makes heroes out of her sons and daughters who represent these high things in high degree. Doing this, she could find no fitter object of such hero-worship than her glorious Pasteur.

I bring here today, in addition to a personal homage to the memory of France's great hero of science, the homage of an American scientific organization that finds in the life and activities of Pasteur perhaps the most outstanding example of the kind of scientific attitude and work which it tries to encourage. Pasteur united in his single self so many of the wise things that modern science has come to recognize as most desirable in scientific attitude and method, that it is difficult to make a choice among them to refer to in this fleeting moment. But to two or three, at least, I simply must refer.

The universities of this country, and of the world for that matter, and the more comprehensive scientific organizations, organize themselves into a series of departments or divisions, each designated to give its attention more or less exclusively to a single field of human knowledge. The scientific fields are called, variously, astronomy, physics, chemistry, biology, psychology, geology, etc., with related but separately organized technological fields of industry, engineering, medicine, agriculture, etc. In doing this we set up artificial partitions, barriers, inside of science which do not naturally exist there. The American National Research Council declares in all of its general announcements, and actually undertakes in its work, to disregard these artificial separations, but with curious inconsistency—tradition is so strong—we are organized as a series of separately staffed divisions named by the names of these various scientific and technological fields.

Now Pasteur, many years ago, in his own interests and work, stepped freely across and through these artificial barriers. He made use of a personal knowledge of and work in different scientific fields in order to solve the problems he attacked. So we celebrate him today as physicist, chemist, biologist, man of medicine and great personal contributor to animal and plant industry.

We have made again for a long time, and shall too often make in our scientific terminology and in our scientific attitude and work another artificial distinction between fundamental, or so-called "pure" science, and applied or practical science. That is a vicious distinction. Pasteur, many years ago, made it neither in his attitude nor in his work. When he learned by his brilliant fundamental researches the secrets of fermentation and the microbic cause of infectious disease, he promptly and no less brilliantly developed the practical application of this knowledge to wine and beer making, silkworm growing, sheep and cattle-raising and to preventive and curative medicine.

It is my special function to speak briefly of his work as biologist, or better of his work in biology. Others are speaking of his work in other scientific fields. Let me say at once, with all deference to the descriptive powers of my colleagues here on the platform, that when we have all done with our talking we shall have conveyed to you only a meager account of Pasteur's enormous and enormously important work, and only a most inadequate picture of the virtues and genius of the man himself.

Before speaking of any of Pasteur's *specific* contributions to biological knowledge I want to mention a more general and great service which he rendered to biology as a science. He was largely responsible for developing in biology the experimental method, that method which has given physics and chemistry their great development and gives them their position as sciences approaching the exact sciences. It was Cuvier, I think, who classified the sciences into three categories: first, and at the top, the exact sciences of mathematics and mathematical astronomy and physics; then the experimental sciences of general physics and chemistry, and, finally, the sciences of observation, the biological sciences or natural history. Since Cuvier's time, however, experiment, and even mathematics, have been introduced into the study of biology with the result of lifting biology to a position of much great scientific accuracy, and hence scientific dignity. It was one of Pasteur's many merits to have turned it once in connection with his work in biology to the experimental method, thereby not only making his own researches much more definitive and capable of successfully resisting attack, but also setting an example which definitely established the experimental method in biological investigation. It was the more natural for Pasteur to do this as he came into biology after he had worked in physics and chemistry.

There are so many things, specific things, that Pasteur did for biology that I can only pick out two or three of them to speak of in my fleeting moment. You have already

heard from Dr. Chittenden of Pasteur's epoch-making work in the field of fermentation. He it was who determined that fermentation was due to the specific action of specific living organisms and that each kind of fermentation has a specific kind of microbe to produce it, and he stepped from this fundamental knowledge, due to his discovery, to the use of it, and he restored and rehabilitated the wine industry of France.

And then he stepped into another field, although one can easily see how he could pass from fermentation to this other. At that time there was a belief held very widely in the world that these uni-cellular microscopic organisms that one finds in water containing organic material, or in any nutritive liquid—that these minute things were spontaneously generated. Up to that time the theory of spontaneous generation of living from non-living materials was nearly universally held. But Pasteur came to think that this was wrong, and his experiments, of which you know something, confirmed by Tyndall and others, reversed the judgment of the world, and now we know that these nutritive liquids, if sterilized and then protected from contamination from without, remain for a long time—forever, one may say, or for as long as they have been observed—without any signs of life in them. "All life from life." And yet the thorough-going evolutionist is put in the curious position, that if he be strictly logical and believes in the continuity of natural phenomena, he must believe that at some time in the history of the world life has originated from non-life.

Pasteur was called on by his countrymen to help them in a great trouble. The silkworm industry of the country was threatened with destruction because of certain epidemic diseases that were running through the silkworm hatcheries. And there, although, as he remonstrated, he had never touched a silkworm—hardly knew one when he saw it—he gave his method and his mind, his genius, to this investigation. These worms were attacked by some disease that revealed its presence by little pepper-grainlike, blackish spots on the skins of the worms, and hence the name, *pebrine*, from the peasant patois word for pepper—*pebre*. He found out that this sickness was produced by a specific organism, just as the "sickness" of wine or of beer is caused by a specific organism that produces a certain kind—and when sick the wrong kind—of fermentation. And so he found that the silkworms were sick because a uni-cellular organism was growing in the bodies parasitically and that it passed from one to another, and even from the mother moth to the young through the egg—one of the extraordinary and almost isolated cases of a form of heredity in which there is direct inheritance by the young of a disease from the mother. The actual germs passed from the mother's body into the egg and so the contaminated egg gave birth to a contaminated larva or worm. And when he had got this far in his work, he began to think, if the sicknesses of silkworms are caused by specific microbes, why not certain human diseases—the so-called contagious or infectious diseases? And he wanted to turn to the study of some human disease, and indeed he did for a very short time, because a minor outbreak of cholera had come into Marseilles and into Paris.

But another cry went up from his suffering countrymen. The cattle and sheep growers of France were losing their herds and flocks because of the disease called *charbon*, or anthrax, and they called for Pasteur to come and study this disease, try to find out its cause and to devise remedies for it, and, with the same method and with the same genius to perceive what was important, he turned his attention to anthrax and was soon able to prove that the anthrax bacilli were indeed—this had been known before—the actual cause of the disease, and that the disease could be carried from one animal to another; but, more than that, he found that this virus, if treated in a special way, in artificial or laboratory cultures, could be made to become weaker and weaker. In

other words, he learned how to attenuate the virus into a vaccine, so that animals that were likely to be exposed, if vaccinated first with this attenuated virus, would be immune from the disease; and probably there was no more dramatic incident in Pasteur's life, or perhaps in the history of biology, than the famous public demonstration on a farm near Melun, where fifty healthy sheep had been put at his disposal and he vaccinated, or had vaccinated, twenty-five, and then, after a series of vaccinations, had them inoculated with the strongest virus that he had, and at the same time had this virus inoculated into the bodies of the other twenty-five, and then declared, "Of the twenty-five vaccinated sheep, none will die. Of the twenty-five un-vaccinated sheep, all will die." And so it turned out.

And then Pasteur was led to give his attention to the matter of human disease, and perhaps the most thrilling scene in the play "Pasteur" is that in which the master leads into the laboratory by the hand a little boy, the forever famous Alsatian lad Joseph Meister, who had been bitten terribly by a mad dog, and whose mother had brought him to Pasteur and supplicated Pasteur to do something for him. Pasteur had been studying the virus of rabies. He had been able to transmit it from animal to animal through the saliva and through bits of the spinal cord, where the organism finally makes its seat. But he was not ready. He had already attenuated the virus. He had a vaccine which would protect animals; but he was not yet ready to try this on a human being. But the mother's supplications were too much for him. The scientific machine, this rare man of science, had a heart; and, although he realized what it would mean for him, for his work, for his reputation, for all this work on rabies, if he should inoculate the boy and the boy should have the disease and die, nevertheless he said, "We will do it." And so the boy, the first human being to be inoculated with the vaccine for rabies, was so inoculated, and did not have the disease. Pasteur foresaw the fate of the boy otherwise, the terrible suffering, the horrible death.

The biologist feels enormously indebted to Pasteur, not alone for the things he has done, his specific contributions to the science, but for those more general things which I spoke of at first, above all the introduction of experiment into natural history or the study of biology.

And finally I want to speak of just two other things. Pasteur did not have an easy life, although before the end came he had that wonderful experience, on his seventieth birthday, of having the whole world come together to greet him and applaud him, and he had the Pasteur Institute, built by popular subscription, the first of the many that exist in the world to-day. But he had to fight to have his views, his radical, revolutionary views, accepted, just as Darwin had to fight to have his views accepted. But Darwin had his Huxley. There was no Huxley for Pasteur. He was himself his Darwin and his Huxley, and in the memorable debates before the Paris Academy, of course familiar to anyone who reads Pasteur's life, he was a plucky antagonist and he never hesitated to take up the gauge of his critics and fight his way through.

And finally he makes another contribution to biology, or to the knowledge of biology, simply in his existence as a genius. Students of heredity have been very much interested, since the days of Francis Galton, the greatest anthropologist of England, in the inheritance of mental capacity and incapacity, and biologists have made considerable steps in learning something of its behavior in the inheritance of unusual mental capacity or the reverse; but of genius nothing. What they have learned is simply the eccentricity of genius. Pasteur's father was a little miller. His mother came from a little gardener's family. And yet the genius sprang from this humble soil. And so that means something for Democracy; that is, although we would like to have that certain aristocracy of brains that one hears about, yet we like to believe that genius, that genius which produces epochs in the life of men, can spring from any soil. That is one of the hopes of Democracy.



DR. JOHN B. DEEVER, Sc.D., LL.D.

*THE PRESIDING OFFICER: "Surgery's Debt to Pasteur."
Who can better measure this debt than a Master Surgeon of our beloved
city?*

*Behold! He enters the House of Life—
His flashing blade he follows fast;
His hand is steady, his weapon bright;
His foe is vanquished and put to flight,
And Life awakens, with anguished breath,—
For man has grappled and beaten—Death!*

Address of Dr. John B. Deaver, Sc.D., LL.D.

Professor Emeritus of Surgery, University of Pennsylvania.

"MODERN SURGERY'S DEBT TO PASTEUR"

This is a day of thanksgiving as well as of commemoration. We have come together from all walks of life, from all branches of science and from all parts of the country to give praise to an immortal. To-day we are in such a state of specialization that the work of each of us is confined to a strictly limited field. The assemblage, therefore, of so many specialists at this time, each eager to tell of the contributions of this one man, this genius, whose centenary we are celebrating, to his own specialty, is more full of meaning than that which any of us or all of us can say.

"Chance favors only the prepared mind."

These words of Pasteur, uttered as a parenthetical phrase in one of his lectures to his students, are significant of the habit of thought and the career of the man whose researches so vitally affected scientific thinking and the scientific activity of his time. While this characteristic of bringing the prepared mind to the study of a subject is an acquired one, when, as in this instance, it is combined with innate qualities, such as imagination, unwavering enthusiasm, accuracy of observation, logical deduction, independence of thought and above all scrupulous honesty and an inordinate capacity for work, it represents the very essential of greatness.

I can think of no other scientist whose work has been so far-reaching and who has contributed to many divergent activities of modern science. We are here to do honor to the man who laid the foundation of bacteriology and immuniology, of modern aseptic surgery, and of modern medicine in some of the most important aspects. Chemistry, physics, agriculture and many of the industries owe to him an incalculable debt. Does not the enumeration of this varied list of debtors indicate the fundamental nature of the discoveries of Pasteur? No scientist, medical or otherwise, in the annals of human endeavor, has produced such lasting benefits for the health and well-being of mankind.

His life emulated that of the ideal research worker, for not only was he able to carry out his investigations into the theory of his problems, but he realized the value of the results and perceived the practical application of them.

His researches began in the field of chemistry, as you have heard, and in this field he made the discovery of the molecular dissymmetry of tartaric and paratartaric acid. By definite steps of logical deduction and accurate observation he went from this first discovery to the fundamental one on which his later contributions depended, that is, the overthrow of the theory of spontaneous generation, and the substitution therefor

of the doctrine that all life proceeds from life, or, as he expressed it, "life is a germ and the germ is life."

In 1856 Pasteur began a long series of experiments which conclusively proved that for each form of fermentation studied by him there was one specific cause and one only. This incontrovertible proof of the role of the germ life in the processes of fermentation and putrefaction represents the turning point in scientific reasoning, scientific research and the practical application of scientific principles. Pasteur's researches along these lines began with a study of the various diseases of French wines and beer. How fortunate that Volsteadism was not existing in France at that time!

Not only were the early investigations of Pasteur important to the brewer and the wine merchant, but they were of vast monetary value to the silk industry. Never in his long life did he admit the possibility of enriching himself from his discoveries, but through them France was enabled to pay off the heavy indemnity imposed upon her by the Franco-Prussian War. Therefore, as Chambrun has said, "his work had become a national possession."

It is significant of the vision which characterizes the thinker, that while still on the threshold of his successful demonstration of the truth of the theory that fermentation, as well as putrefaction, was an effect of life, Pasteur saw the analogy between fermentation and disease, and even then hoped that these studies might be pushed far enough for a serious investigation into the origin of various diseases. From this pious wish there ultimately resulted what may well be considered Pasteur's second greatest achievement, that of immunization against infectious disorders, forming, as it does, the basis of modern methods for the control and possible eradication of certain diseases.

Pasteur's work in this field was not done without having to overcome obstacles thrown in his way by ignorant people who could not realize the extent of the mischief they might have done had their plans succeeded in preventing Pasteur's use of animals for experimental work. Huxley in 1889 wrote to the Lord Mayor of London in regard to the opposition of the anti-vivisectionists to a contribution to the support of the Pasteur Institute:

"It proceeds partly from the fanatics of laissez faire who think it better to rot and die than to be kept whole and lively by State interference, partly from the blind opponents of properly conducted physiological experimentation, who prefer that men should suffer rather than rabbits or dogs, and partly from those who for other but not less powerful motives hate everything which contributes to prove the value of strictly scientific methods of inquiry in all those questions which affect the welfare of society."

How else would and how else will the boundaries of surgery be broadened, if our work is to be hampered by legislative restriction? Pasteur, like those who preceded and followed him, was opposed and decried, instead of being encouraged and helped. For unfortunately, the politician sees no votes in experimental research and the layman rarely appreciates its value.

Not only were his proofs of the existence of specific transmissible microbes questioned, and the necessity of animal experimentation in order to isolate and find modes of destroying these organisms denied by the layman, but even the medical profession of France received his work with incredulity and lack of interest. It is unfortunate that the medical profession was unable to discern the truth. Notwithstanding the hostility and opposition, Pasteur carried on his work, demonstrating even more fully by his results in the diseases of anthrax and rabies, the correctness of his theories. The truth is mighty and will prevail.

The generosity of this truly great mind is evident in the fact that, during the pro-

gress of his painstaking and interesting endeavors, Pasteur, instead of coining a new word for his protective injections of attenuated virus, chose the term vaccination, which had been used by Jenner, because of its derivation from *vacca*, the cow. In thus acknowledging his indebtedness to Jenner, the originator of this preventive measure against smallpox, Pasteur, in addressing a meeting of the International Congress of Medicine in London, remarked:

"I have expanded the meaning of the word vaccination, which I hope will meet the approval of science, since I wish to pay homage to the tremendous service rendered to humanity by one of England's greatest men—your Jenner. Indeed, I deem it a special privilege to honor his name in this noble and hospitable city of London."

What surgery owes to Pasteur is the firm foundation which made possible the great edifice of modern surgery, still in the process of erection but which is now showing its real magnificence and noble concepts. On this foundation laid by Pasteur, Lister was able to begin the erection of the super-structure of aseptic surgery. In 1874, Lister writing to Pasteur said, "If you came to Edinburgh, you would be rewarded by seeing at our hospital in what full measure your labors have benefited the human race. Need I add what a great satisfaction it would give me to show you here what surgery owes to you." What a joy this tribute from a master surgeon and scientist must have been to Pasteur, surrounded, as he was, by those who seemed blind to the truth.

The great evils of the nineteenth century in the field of surgery were pain and infection. After the year of 1846 we find the introduction of anesthetics to abolish pain becoming general. This completely revolutionized the possibilities of the application of surgery to diseased processes. However, the hope that the surgeon, with the abolition of pain, might extend his field of usefulness beyond a few minor operations and emergency amputations, was hampered and frustrated by the all too frequent occurrence of infection, with all its disastrous consequences. Occasionally a wound healed primarily, without the formation of pus, but the majority became "putrid" to use the then current phrase, or as we say, infected. It is impossible for me even to attempt to portray the horrors and mortality attached to surgical procedures at the period when Pasteur was conducting his researches. Pus poured from the wounds, and hospital gangrene, erysipelas, pyemia, and septicemia were stumbling blocks to all surgical process. The risks of entering a hospital were so great that the surgeon's hands seemed indeed to be paralyzed by the fear of hospital disease, "that blind Nemesis that presided over their work." Operations performed in private houses gave much better results than those in old hospital wards with their overcrowded, unsanitary conditions and accumulated infection. Even the cleanest hospitals of that time were hotbeds of infection; patients with suppurating wounds crowded in a single room without any precautions to protect one from the other. In fact, the conditions were ideal for the transmission of infection from doctor to patient, and from patient to patient. It is difficult for this generation to realize the status of hospital technique in those days and the changes that have been wrought since then. A few words may suffice to give you a slight idea of the change.

In those days any room was used as an operating room and any old coat, the older apparently the better, served the surgeon as an operating gown. Sometimes a linen duster was the garment chosen, and when a young man actually discarded his coat and worked in his shirt sleeves, he was looked upon as a bold innovator. Sponges, so-called surgical sponges used during the operation, were of better texture than ordinary bath sponges, and when of good quality they lasted a long time. They were used over and over again and sometimes they would even serve for removing blood from the table and perhaps also from the floor. After being washed in ordinary water they were placed

uncovered in a bag, along with the surgical instruments, ready for the next victim. Assistants at the operation stood around without regard to protecting the patient from infection carried on their clothing or their hands. Infection was not, as to-day, a disgrace and an exception, but almost the invariable rule. No wonder that going to a hospital meant leaving all hope behind.

When, therefore, Lister, who had been working long in Glasgow on the problems of inflammation and the decomposition of wound discharges, read in 1865 of the work of Pasteur, he realized that the results were applicable to surgery. Lister read Pasteur's assertion that "the most far-reaching of my researches is simple enough; it is that putrefaction is produced by living ferments." In this same dissertation Pasteur differentiated between aerobic and anaerobic infections.

Pasteur threw light on what had hitherto been darkness and Lister, with the mystery dispelled, wrote in 1869:

"When it had been shown by the researches of Pasteur that the septic property of the atmosphere depended on minute organisms, it occurred to me that decomposition in an injured part might be avoided, by applying as a dressing some material capable of destroying the life of the floating particles."

This marked the birth of antisepsis in surgical procedures, and was the culmination of the unceasing labors of the French scientist, conferring one of the greatest, if not the greatest, boon to suffering humanity.

With this pronouncement of the principle of antisepsis and its subsequent development into that of asepsis, the main barriers in the path of surgical advance were thrown down. With a phenomenal pace the onward march has continued and at this time there is practically no part of the human body closed to the aseptic knife. The surgeon has advanced from the limbs to the trunk, from the abdomen to the cranium, from the cranium even to the heart, until it seems as if the Listerian knife were to prove the long-sought panacea.

There naturally followed also a complete revolution in operating room technique and hospital conditions. The words "surgically clean" now imply the acme of cleanliness, to be attained only in a modern hospital. The ordinary wash basin has given way to porcelain-lined trays, sea sponges to gauze used but once, the bone or wooden-handled knife to the one-piece metal instrument. The protection of the patient is the prime consideration. Doctors and nurses are clothed in immaculate sterile gowns, with masks covering mouth and nose, and the operation itself is conducted in a well-lighted clean room, with sterilized instruments, and the operator's hands encased in sterilized rubber gloves. Draw the comparison! The surgeon works with a reasonable certainty of success, not born of arrogance, but with the knowledge derived from the application of the scientific principles of protection as formulated by Lister, but based on the work of Pasteur. The emblem of despair no longer darkens the doors of our hospitals, but has been replaced by that of fully justified hope for restoration of health and vigor. No longer is the mortality of amputations from forty to fifty per cent. While Lister, in 1865, wrote that in fifteen cases of excision of the wrist joint by his method, six patients developed hospital gangrene and one died of pyemia, to-day these complications are the curiosities of the surgical ward. The term "hospital" itself may be said to have resumed its original meaning of a hospice or haven for the tired, stricken traveler along life's journey. Hospital treatment, instead of being shunned, is eagerly sought by poor and rich alike; indeed, the supply scarcely meets the demand.

In no branch of medicine and surgery are the beneficent effects of this revolution more apparent than in the protection afforded the expectant mother in her hour of supreme trial. As has been well said, with his antirabic inoculations he conserved the

child for the mother; and with his demonstration of the cause of puerperal fever he conserved the mother for the child. The frightful mortality from so-called epidemics of puerperal or child-bed fever is happily a thing of the past, because Pasteur discovered the minute organism which caused the fever. It is related that at a meeting of the Academy of Medicine of Paris, during a discussion on the subject of puerperal fever, Pasteur interrupted the remarks of one of the most eminent physicians of his time, by boldly calling out from his seat: "You are entirely wrong as to the cause of these epidemics; it is the doctor and his assistants who carry the microbe from a sick woman to a healthy one." The speaker replied that he scarcely thought this microbe would ever be found, whereupon Pasteur jumped to the blackboard and drew the now familiar figure of a chain of streptococci, saying, "There it is, that's what it looks like." Pasteur discovered the cause and Lister applied the remedy, and the safety of motherhood has been practically assured.

What surgery also owes to Pasteur and to Lister is the extension, not only of the operative field of the surgeon, but the expansion of his knowledge of diseased processes; that is to say, the opportunity of observing a given disease in its various stages. Hitherto the practice of surgery had been based upon the knowledge obtained from the study of clinical symptoms and of the terminal stage of disease as seen in the post mortem chamber. The latter, as we know, led to incorrect deductions due to false impressions, resulting from the changes produced by death. These inaccuracies we are now able to replace with the more accurate observations on the living subject in the operating amphitheatre. For example, it certainly is of more value to see the precise conditions which cause, let us say, a gastric trouble, a trouble of the stomach, at the time of the illness, than to observe the same trouble some time later, when perhaps other changes during life and after death have been added to the pathological picture. In order to heal the living we need the knowledge derived from living processes. This knowledge, when correlated with clinical symptoms, is necessarily reflected in our greater ability to make a correct diagnosis and consequently in improved methods of treatment; for, instead of treating only symptoms, we are now in a position often to focus treatment directly on the basic cause of a disorder. And in this way surgery falls in line with preventive work, the watchword of our times, which in the last analysis represents the ultimate triumph of Pasteur. For the physician who does not stand at the elbow of the surgeon and is not guided by the revelations disclosed at the operating table will often go astray. So you doctors, take heed!

If then, his work is to be judged by his contributions to humanity, Pasteur will, and should, rank with the greatest of the immortals, for his has been the guiding hand in the abolition of the surgical disasters of our forefathers.

Paget, as has been well said, admirably describes this immortal figure in the history of the world:

"To change the whole outlook of medicine and surgery, Heaven took and trained a 'pure scientist,' who had never done an operation nor written a prescription;—there are many of us to-day who have not written certain prescriptions—'a man who had to screw up his courage even to look at some of the ordinary sights of a hospital; took this non-medical man of science and set him to be head of all the heads of the medical profession, to have them all obedient to his teaching, and proud of the very sound of his beloved name. * * * The whole world is well aware that he has availed more than the physicians and surgeons of his time for its health and happiness. He was set apart from them, that he might be the leader of them; and he led them into that kingdom which they longed for, but could not have found for themselves.' "

And so, on the centenary of his birth and the twenty-seventh anniversary of his death, we have gathered here to say words in simple tribute. But words are powerless, while the child of his genius is still nobly testifying to its truthful conception and fulfilling the highest hopes of an enlightened and enriched science.



DR. HUGH S. CUMMING



THE PRESIDING OFFICER: The chapters of Pasteur's experiments bordering on public health abound in facts of the most profound nature. They touch society on all sides, and particularly the home. We have with us this afternoon a master in this domain, renowned for his erudition—the distinguished Surgeon General of the Public Health Service—Dr. Cumming.

Address of Dr. Hugh S. Cumming

Surgeon-General, Bureau of Public Health Service, Washington, D. C.

“PASTEUR'S INFLUENCE ON PUBLIC HEALTH”

If one were to attempt the evaluation of the life work of Louis Pasteur in terms of human knowledge and human welfare, he would face an enormous, if not an impossible task. This, of course, arises from the fact that his discoveries were fundamental and that their influence extended far beyond the solution of the immediate problems which suggested his researches. Like the ripple which is caused by dropping a pebble into the sea, this influence has been transmitted to the most distant shores, but with the significant difference that there has been a constant augmentation in volume, so that we are given a hope that the resulting waves of human knowledge will ultimately break down and wash away many of the rocks of ignorance which have stood between us and our goal.

Fortunately, it is not my task to even outline the total accomplishments of this wonderful man of genius, for even in the limited field which it has fallen to me to discuss, one must feel a sense of total inadequacy. It is not too much to say that the greater part of successful present day public health practice is traceable directly to the influence of Pasteur.

Pasteur was the first to completely and for all time refute the doctrine of spontaneous generation. Until this time it had been the accepted teaching and belief that living things could under favorable circumstances originate *de novo* and without relation to preceding forms. If this were the case then as a corollary any disease which was due to infection by a micro-organism could also arise *de novo* without relation to any preceding case. As a matter of fact, while the contagiousness of certain diseases has long been recognized, their spontaneous origin was also believed to be possible under favorable conditions, and as a natural consequence physicians and health officers were at little pains to determine the origin of a disease in another case, or to take vigorous and effectual action in preventing its spread. The doctrine firmly established by Pasteur, that every living thing must come from an antecedent living thing, has changed all this idea. We now practice the control of infectious diseases on the basis of the doctrine of Pasteur, and with the sure knowledge that if a person suffer from an infection, the germ which causes that infection came from some outside source which it is our duty in so far as possible to trace, and that if we are able to control the sources of such infections we need fear no “spontaneous” outcroppings of the disease in question. The full significance of this change of attitude has yet to be fully realized in practice, but it has already given us the means of control of some of the most serious epidemic diseases, and provides us with a confident hope that mankind may some day shake off completely the terrible load of infectious diseases under which it has been laboring throughout its history. Professor Tyndall in a celebrated letter to Pasteur uttered a prophecy which

the experience of half a century has fully confirmed. "For the first time in the history of Science," he said, "we have the right to cherish the sure and certain hope that, as regards epidemic diseases, medicine will soon be delivered from quackery and placed on a real scientific basis. When that day arrives, Humanity, in my opinion, will know how to recognize that it is to you that will be due the largest share of her gratitude." This letter was only written after Tyndall had himself repeated many of Pasteur's experiments and had confirmed the truth of his doctrines.

But it must not be imagined that Pasteur was accepted with enthusiasm by all of his contemporaries. The triumph of his ideas only came after a prolonged conflict with the champions of conservatism. The issue was plainly stated by Pasteur in a letter addressed to one of the most obstinate and active of these champions, who after some imperfect experiments had thought he had demolished the new teachings. Pasteur wrote in 1877, "Do you know why I desire so much to fight and conquer you? It is because you are one of the principal adepts of a medical doctrine which I believe to be fatal to progress in the art of healing—the doctrine of the spontaneity of all diseases. . . . That is an error which, I repeat it, is harmful to medical progress. From the prophylactic as well as from the therapeutic point of view, the fate of the physician and surgeon depends upon the adoption of the one or the other of these two doctrines."

This discovery of Pasteur's that the germs of disease do not originate spontaneously is probably his most far-reaching contribution to the cause of public health. I should like to trace its ramifications throughout some interesting phases of public health work, many of which could hardly have been anticipated by the master himself, but I can only pause to give a single illustration. Who could have foreseen, for example, that the great principle enunciated by Pasteur would by means of its subsequent development give us the means of control of a significant proportion of cases of insanity or of blindness? And yet the successful attack now being made on these conditions through the venereal disease campaign is traceable directly to Pasteur's influence.

The applications to such diseases as Asiatic cholera, bubonic plague, yellow fever and typhoid fever (to mention only a few out of many) are sufficiently obvious to occur to anybody of intelligence in these days.

It is interesting to note that Pasteur gave us also the rudimentary conception, at least, of intermediary vectors in the transmission of disease, by his demonstration of the role of the earthworm in the conveyance of anthrax. The subsequent developments of this conception into the present day knowledge of the transmission of plague by the flea and of yellow fever and malaria by the mosquito, may not in all instances be traced to his influence, but it must still be admitted that in this, as in so many directions, he was a pioneer.

The next most important contribution for which we must gratefully thank Pasteur, was his demonstration of the possibilities of artificial immunization against disease. To be sure, in this regard he was anticipated by Jenner, as has been stated, but Pasteur pushed the matter far beyond Jenner's conceptions, inasmuch as he was the first to produce immunity by the use of bacterial cultures as distinguished from unknown viruses. His discovery of the effectiveness of attenuated cultures in preventing chicken cholera may be said therefore to mark an epoch in one phase of public health work. It was the direct forerunner, for example, of the process of typhoid immunization at present employed with such brilliant success in our armies and elsewhere.

It is not my purpose to review Pasteur's separate and particular contributions to medicine and bacteriology, but surely one must refer briefly to what is regarded by many as his crowning achievement—the development of what is still universally known as the "Pasteur Treatment" for hydrophobia. It was characteristic of this man's nature

and humane disposition that he should regard with peculiar satisfaction an accomplishment which was to save from a terrible death thousands of persons, a large proportion of whom were children. From a public health standpoint this discovery is still of major importance, since the Pasteur treatment still remains in many areas our chief reliance in preventing death from hydrophobia. The difficulties in the way of the more logical control of this disease at its source in the dog, are still unfortunately insuperable in many parts of our country.

Another contribution of Pasteur's which has come to have widespread public health importance, perhaps more far-reaching than any other, in many senses, is his demonstration that the heating of wines to a degree far below the boiling point would prevent their spoiling, and at the same time would not interfere with their potability. In its modern application to milk supplies this process of so-called "pasteurization" has become well-nigh indispensable in modern civilization. It is recognized that our milch cattle are infected with tuberculosis to a degree which makes the eradication of the condition an impossibility within the immediate future. Moreover, experience has shown us that the control of milk handlers by surely detecting incipient cases and disease carriers among them in time to ward off dangerous contamination of milk by them, is an economic impossibility. And yet we need milk. Our growing children, not to mention adults, require this healthful food in much larger amounts than those in which it is at present available. Efforts must be made to supply it in greater quantity and at a cost so cheap that the poorest may at least be able to supply it to the children. The possibility of supplying such milk in larger quantities is almost entirely due to this great man's work. Pasteurization is the process which makes this program possible, and this is merely an obvious adaptation of the method originally applied by Pasteur to wines—a modification of the time and temperature requirements to suit a different medium, containing different organisms.

A complete public health program must involve contributions from many, in fact from all, special lines in the arts and sciences. Thus, notably in its school health work and in its propaganda against cancer, it must frequently refer to the surgeon. The confidence with which this reference can be made is only made possible by the assurance that the surgeon will employ an aseptic technic. You have all heard of the great work which Pasteur has done in making that possible.

I have already cited an instance in which public health practice is indebted to Pasteur for a life-saving measure based upon a study of immunity—the use of rabies vaccine. It must be acknowledged, I think, that the work of his great fellow-countryman Roux, and others in perfecting diphtheria antitoxin, would hardly have been possible, at least not at the time, if Pasteur had not paved the way by his demonstration of the existence of toxins. He had shown clearly that pathogenic micro-organisms are sometimes injurious not by reason of their direct action upon the tissues, but through poisonous products which are produced as a result of their growth.

Public health practice, in order to achieve its most effective and economical development, must be founded upon established scientific facts. It must conform to the fundamental findings of chemistry and biology. I have hitherto referred to Pasteur's contributions to biology, but it must be remembered that his training was that of a chemist, and that his contributions to chemistry were perhaps no less important than those which he made to biology. These were made at a time when certain ideas now known to be untenable, were advanced by the most learned and revered teachers, and threatened to dominate chemical knowledge and research for some time to come. At this critical period Pasteur, by his researches on molecular constitution and on the nature of fermentation, turned the scales in favor of conceptions which have been most fruitful. Realizing

as we do that in public health we are dealing ultimately with questions of physiology and pathology, and that these subjects are inevitably associated with chemistry, it is apparent that on this account also we owe a debt of gratitude to the genius of Pasteur.

The laboratory is now recognized as an indispensable factor in successful public health work, not only as a research instrument, but as a necessary adjunct to the carrying on of the day's field work. It is true, no doubt, that if the clinician and the field worker had more intimacy with the laboratory, and if the laboratory worker had more familiarity with field and bedside conditions, progress would be more rapid and certain. But when we contemplate the unsatisfactory state of medicine and sanitation before the introduction of laboratory methods in which Pasteur was a matchless pioneer, we have ample grounds again for gratitude and congratulations.

It is particularly important at the present time, when in the generally disturbed state of society, new cults and fads are springing up on all sides that we should hold fast to those things which can be proved by experimental methods. Let us not, like many of Pasteur's conservative contemporaries, stand in the way of progress by a hide-bound adherence to convention and tradition, but before declaring allegiance to new theories, let us demand that experimental proof be forthcoming, or at least that the new ideas are not incompatible with things which we can prove by trying out experimentally.

In closing, I wish to refer to the influence of the man himself, quite aside from the concrete contributions to science. He is an inspiration to the public health man because of his unswerving fidelity to the truth, his tireless devotion to the cause, and his fearless courage in defending what he thought was right, and he has served as an inspiration to thousands of scientific workers and public health men to do their best. But his natural gifts have been the despair of those who would emulate him. The almost uncanny assurance with which he selected the one thing which would enable him to solve his problems surely and quickly, gives evidence of a trained and developed imagination such as few of us possess. It is for this reason I believe that while his problems were not abstract, and their solution was of immediate practical value, he never failed to see and to appreciate the bearing of the principles which were involved, and it is because of this particular quality of his work that public health of to-day owes him such an enormous debt of gratitude.



M. JULES JUSSERAND, LL.D.

THE PRESIDING OFFICER: On one occasion, after listening in all modesty and humility to flattering encomiums showered upon him, Pasteur said to the young men in his audience:

"Whatever your career may be, do not let yourselves become tainted by a deprecating and barren skepticism; do not let yourselves be discouraged by the sadness of certain hours which pass over nations; but ask yourselves what have I done for my country? until the time arrives when you may have the happiness of thinking that in some way you have contributed to the progress and good of humanity."

Surely, no man can speak more intelligently and sympathetically of the human side of the great experimenter than his countryman—the eminent scholar, the keen, discerning diplomat, the trusted Ambassador from fair France to our own native land—M. Jusserand.

Address of M. Jules Jusserand, LL.D.

Ambassador of the French Republic, Washington, D. C.

"PASTEUR AS A MAN AMONG MEN"

Mr. Chairman and Ladies and Gentlemen: To-day, throughout the world, in a number of cities, the memory of Pasteur is being honored. It is being honored in the United States as in France, and we hear that it is being honored also in Berlin—which I take as a sign and harbinger of better days.

But in no city is it more fitting that that great memory be honored than in your city of Philadelphia, the city of Franklin, the city of brotherly love, the city of independence; of Franklin, whose discoveries, generating other discoveries, are still useful to mankind; of brotherly love, the ideal of your founder and the ideal of our Republic, the aim of which is in our motto—"Liberty, Equality, Fraternity;" an ideal not yet reached, but which we all hope will be reached one day.

Pasteur expressed himself on the question of fraternity and of the delicate problem of science having or not a country, saying:

"I have two profound impressions, one that science has no country, the second which seems to exclude the first, that science is the highest personification of country. Science has no country, because learning is the patrimony of mankind, the torch which lights the world. Science is also the highest personification of country, because, of all peoples, that one will ever be first which will rank first in the works of thought and intelligence."

Independence, in all its forms, was beyond words dear to Pasteur. When the republic was proclaimed a second time in France in 1848, the enthusiasm of young Pasteur, then a student in the Normal School, knew no bounds. He enlisted in the National Guard and wrote to his father how glad he was to risk something for the "sacred cause of the Republic," and having gone out one day near the Pantheon, he found a wooden booth with the inscription "Autel de la Patrie,"—Altar of the Country—and it was a booth where offerings were being received for the cause of liberty. He straightway went home, brought out the sum total of his savings, which amounted to not less than one hundred and fifty francs, and with nothing left for himself, brought it back and placed it on the altar of his country.

Later the loss of Alsace-Lorraine in 1871 filled him with heart-breaking despair. "Right and force," he wrote in those sad days, "compete for the domination of the world; right, which has formed and preserves society, force, which subjugates and oppresses nations."

Chief of all, in his eyes, was the independence of thought of the man of science. The severest tests were to be applied, and ever renewed, to all beliefs and discoveries, time-honored as they might be, fruitful as they might have proved: who knows whether new testings might not demonstrate, if not the falsity of the doctrine, at least some new way to expand it and make it more useful for mankind? He, a master, had a profound aversion for the *magister dixit* which had trammelled mankind throughout the middle ages, up to the modern era. He constantly checked his own experiments and he wanted others to check them too.

One of the members of the French Academy and a member of Parliament, Denys Cochin, in one of his speeches to Parliament recalled a little pamphlet he had been so bold as to write on a question of chemistry and which he presented to Pasteur. Pasteur looked at the booklet and saw the first words, which were "We know that * * * *"
"What a beginning!" said Pasteur, "What do we know? Nothing." Denys Cochin said, "But wait; what I quote is one of your works." Pasteur retorted, "It is all the same, you should not have accepted it as a matter of course."

His face, as I remember him, and as most of his portraits show, was serious, almost sad, almost austere, as of a man only interested in grave problems concerning the fate of mankind who works, who suffers, who does not know. But also in the dark eyes there were revealed possibilities of a mute and reticent tenderness. Pasteur inspired not only awe but sympathy at first sight, a sympathy which no one but a fool would have been so bold as to express at first sight.

When he was received as a member of the French Academy, Renan observed that a pure scientist was rarely admitted into that society, chiefly founded for men of letters. "But," he added, "aside from the question of doctrine on which we cannot pass judgment there is a kind of mastery, sir, on which our familiarity with the minds of men allows us to express an opinion. There is something which we know how to recognize in the most various applications, something which belongs, in the same degree, to Galileo, Pascal, Michael-Angelo, Molière, something which causes the sublimity of the poet, the profundity of the philosopher, the fascination of the orator, the divination of the scientist. This common base of all the works endowed with truth and beauty, this divine flame, this peculiar breath which inspires science, literature and art, we have found it in you, Sir: it is genius."

Genius is of God. Its development and use is of man. Pasteur's genius found its development owing to his pure and exacting conscience, owing to his firm will and owing to the teachings of one of those straight-thinking, straight-acting families, so numerous among us in reality, so rare in our novels—but reality is better than fiction—those families which are the backbone of France. Late in life, when a tablet was placed on the house where he was born at Dôle, Pasteur said: "Father and Mother, my dear lost ones, who lived so modestly in this little house, to you I owe everything.* * * * *
To look upwards, to learn beyond, to try and improve, this is what you taught me."

"To look upwards"—Can there be a better motto for one's life, a better amulet to help one pass unscathed through the midst of the fumes of discouragement, indolence, dilettantism, egotistical enjoyment, skepticism, and all the causes of the wasting of force, intelligence and possible generosity, and that skeptical, sneering, What is the good? which is so baneful and dangerous to the youth beginning the journey of life. How I wish that some moral Pasteur could find the microbe thereof and exorcise it! "Look

upwards," the tanner of Dôle and Arbois used to say to his son, and that son, whose voice shall never be silenced, still repeats, dead as he is, his advice to the youth of our day. He himself more than once warned the young men about him, whom he loved with that half-mute, half-veiled tenderness of his, to be on their guard against sterile, scornful skepticism. Those warnings were given a last time when that supreme homage was rendered him by France and by the world in 1892, and he was so ill and weak that his speech had to be read by that brave young son of his, whom I knew as Secretary of Embassy (for he followed my profession), and who, worthy of his father, had enlisted, a boy of eighteen, to defend his country in 1870:

"Young men, young men, trust in those sure and powerful methods, the first secrets of which is all that we know at present. And all of you, whatever be your career, do not allow sterile, scornful scepticism to reach you; be not discouraged by the sadness of certain hours which pass over a nation * * *. Say to yourselves: What have I done for my instruction? then, as you progress, What have I done for my country? Until you reach the moment when you may possibly have the supreme happiness of feeling that you have contributed somewhat to the progress and to the good of mankind. But, whatever the outcome, act so that you can say to yourself when you reach the great goal: 'I did all I could.' "

He himself had had to educate his own will, weakened in early life, not by any tendency to scepticism as to the usefulness of effort, but by that very tenderness which, for being concealed, was preying the more on his nature. Sent to Paris as a boy to perfect his studies, he had been unable to continue, he had fallen into a sort of languor through homesickness. He longed for his native hills and village and for his parents and for the tannery where he had grown up. "If I could only smell the smell of the tannery," he said to a boy friend, "I think I would be well again." His earliest fondness was for art and he won local repute as a portrait painter; his earliest literary admiration was for sentimental poetry, especially the "Meditations" of Lamartine, in the same way as the earliest admiration of Lieutenant Bonaparte was for Ossian. The genius of both, as all the world knows, developed on different lines.

Pasteur's longings for home affections received their full satisfaction in a happy marriage and the rearing of a once numerous family of four girls and a son, only one now remaining, Madame Vallery-Radot, wife of the author of the great and classical *Life of Pasteur*, in my eyes one of the masterpieces of biography. And then he had around him his pupils, who became his beloved friends, his helpmates, the defenders of his doctrine, later the continuers of his work.

What was that doctrine? You have heard of its effects. You have heard of its immense results for mankind. That doctrine may be summed up in a word: Truth above all. Imagination, intuition, hypothesis, are indispensable. For the man of science, imagination is as necessary as for the poet himself. He must devise, propound to himself supposition after supposition. The greater, the more wonderful, the more beautiful the possibility, the severer must be his verification and the more numerous his experiments, and Pasteur has splendidly described the sort of torture that the scientist duly endowed with imagination must undergo in order to try to demolish his own theory, to see if really there is truth in it or not.

"What I ask of you," he once said to his pupils, "is what is most difficult for a discoverer. To believe that one has found an important scientific fact, to be feverishly anxious to announce it, and yet to check one's self, for weeks, sometimes for years, fighting one's self, trying to ruin one's own experiments and waiting before proclaiming one's discovery until all the hypotheses to the contrary have been tried, yes, this is a hard task. But when, after so many efforts, you at last reach

certitude, you experience one of the greatest joys a human soul can know, and the thought that the honor of your country will thus be increased causes that joy to be still more profound."

The result of this rigorous method you know better now that you have heard his brother scientists, those honored Americans, assembled here who continue the practice of his method, and who, being generous because they are Americans, are quick to recognize the merits of those born on the other side of the ocean in the friendly land of France.

A complete man, interested in industry, in agriculture, in all the troubles, pains and sorrows mankind is heir to, he ever thought of the practical applications to be made of the laws and secrets he had discovered. A number of industries, agriculture, the health of our cities, as was just shown by the Surgeon-General, immensely profited by these marvelous practical applications. Of course, all that he discovered he gave, as the higher scientific minds will ever do, as your Franklin ever did, as a gift to his country and to the world. Speaking, years before the end of Pasteur's career, the great English scientist Lister took the trouble of calculating that the product of the discoveries of Pasteur had, even then, balanced the five billion that hard-working, serious-minded France, unflinchingly, honorably wanting to make good her word and signature, had paid to Germany, after the war of 1870, and paid ahead of time. All countries had of course profited as well as France, Germany not excepted.

Those discoveries were so prodigious and so new, opening such vistas, upsetting so many received ideas, and upsetting even the professorial chair of so many traditionalists, that criticism, not always marked by good faith, was prolonged and bitter. To sincere critics, Pasteur was all kindness and one of the great joys in his early life had been when one of his elders, the great chemist and astronomer Biot, who had long doubted one of Pasteur's discoveries in crystallization, after himself making the experiment and finding that it was really a new discovery, exclaimed: "My dear child, I have loved science so during all my life, that to see this makes my heart beat."

But to others, to fakers, to false scientists, to false anything, he was adamant. Those people, the insincere, the envious, the vainglorious, the false, form throughout the world and throughout the ages a kind of fraternity. Distance is nothing; the ages are nothing; without knowing each other, they understand each other; by a sort of secret instinct they act in agreement; they league among themselves against the new discoverer, the new man. They leagued themselves against Pasteur; they had leagued before against Socrates.

For these, no sweetness, no tenderness, no half measures. Whatever their rank or repute, whatever the consequences, Pasteur, impervious to fear, stood intractable, blunt, peremptory, trenchant. And why? Because when he was defending his discoveries, become certain after so many verifications and counter verifications, he was not defending Pasteur, he was defending truth. But when his own person alone was in question he was once more the boy, the modest student of the earlier days. Nothing more characteristic than a little incident on the 3rd of August, 1881, in London, when a great International Medical Congress was being held. There was an immense gathering in St. James' Hall and Sir James Paget came in with Pasteur. The whole assemblage, which filled the building to the cornices, rose and applauded to the echo. "Let us make haste," said Pasteur to Paget, "we are late, the Prince of Wales must be arriving."

In the crypt of the Institut Pasteur founded in his lifetime by public subscription, he now sleeps his last sleep and the history of his discoveries is told in green and gold mosaics around his cenotaph. It is a place of pilgrimage. Many come from this country and all, in the presence of the tomb, think of what Pasteur did, how he spent his own days

in helping others and how he succeeded in that attempt of his to "move further the frontiers of life."

France has produced many great men in her history. There is not one among them of whom we are more proud than of Pasteur. Some years ago, before the war, one of the papers arranged a symposium, a kind of plebiscite, and asked everybody to say who was, to their mind, the greatest of the sons of France. Two million three hundred thousand answers came and in that militaristic nation of ours—read the papers—in that militaristic nation, Emperor Napoleon was given the seventh rank; Pasteur, the first.

The city of Boston recently opened an avenue leading from the city to the new School of Medicine. To this avenue was given the name of Pasteur, and it was decided that the name should be written, French fashion, "Avenue Louis Pasteur." I knew that that admirable man, the then President of Harvard, now President Emeritus, Charles W. Eliot, had had much to do in the devising of those words—if any man in the world is great at inscriptions it is Charles W. Eliot—and I wrote him to express my deep appreciation. "Yes," he answered, "I wanted very much that it be so: I hope that generation after generation of young Americans who will follow this avenue will ask why its name is so written. And the answer which they will get will do them much good."

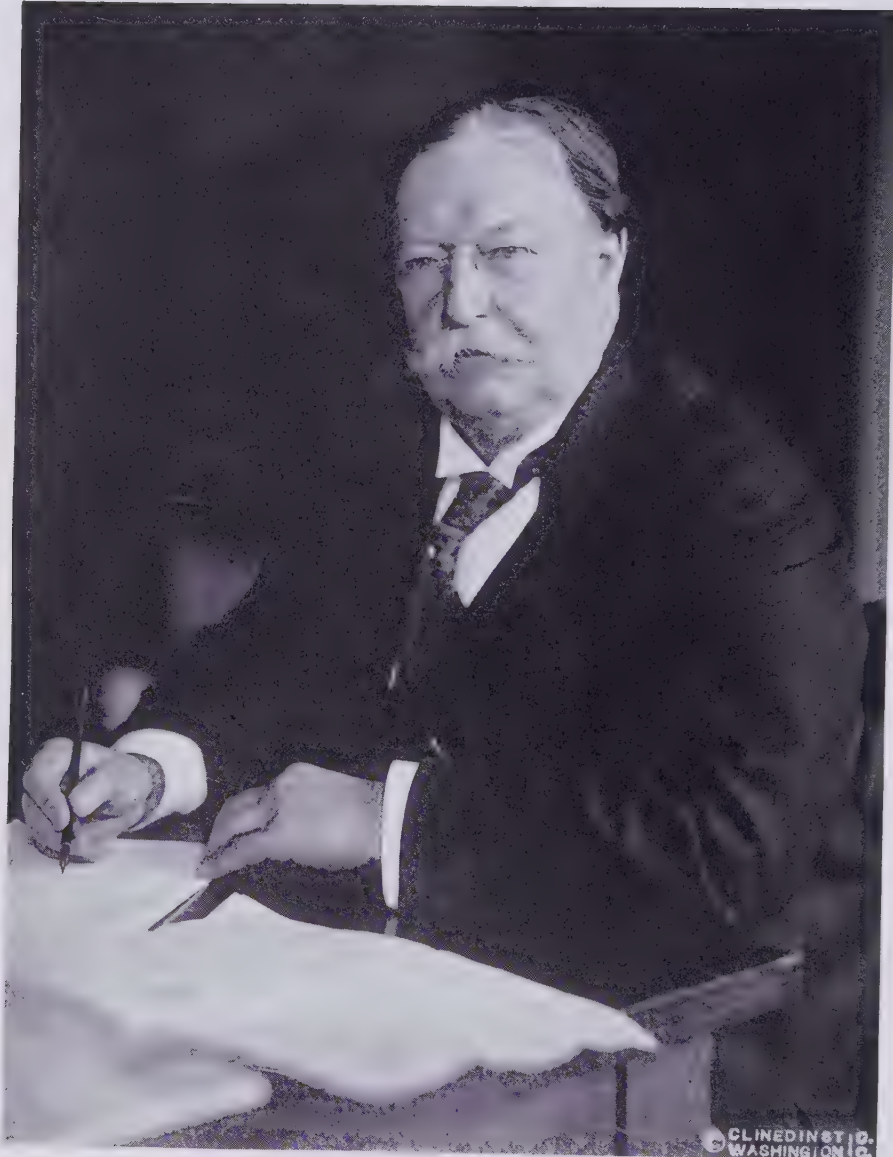
The same for all. The career and examples of Pasteur deserve to be studied and meditated upon. To all those who try, who contemplate his life, who think of his services to mankind, of his inward modesty and of his seriousness, that contemplation will do much good. And thus it is that, in a sense, great citizens never die; they remain ever present; they help us, they console us, they advise us. Franklin still helps Philadelphia and the United States; Pasteur still helps France.



PRESIDENT WARREN G. HARDING

And through our honored friend, the Ambassador of France, President Harding sends these lines:

“The wonderful advances of medicine and surgery are the direct results of Pasteur’s life and work. He has shown the relation of germs to disease and how to prevent disease by destroying these germs. Already many infectious diseases have been conquered, and as a result the length of human life has increased. Preventative medicine is now a science and its result to the world is of incalculable benefit. America has been among the first nations to apply Pasteur’s work to practical use. The building of the Panama Canal was made possible by the knowledge of the part played by germs as the cause of yellow fever. The health of a people is essential to the progress of a nation, for without health there can be no prosperity. Realizing therefore the great debt of gratitude the whole world owes to Pasteur, I am delighted to know that Philadelphia is taking such active part in the celebration of the centenary of Pasteur’s birth, and wish to lend my best support for its success.”



HON. WILLIAM HOWARD TAFT

The great Chief Justice of the United States, former President William H. Taft, bids me read these, his words to you:

“In the discovery of the bacterial cause for much of the disease from which humanity suffers and the demonstration of the inestimable value of the discovery in avoiding, resisting and curing it, Pasteur was one of the greatest benefactors of the human race in all history. His name must be preserved and revered in order to inspire others to new revelations of the laws of God for the benefit of man. Nothing tends to show the Divine progress in man so much as such proved capacity to unlock the secrets of the Divine law in his own creation, life and death.

“Pasteur was a son of France with the keenness of perception, the brilliancy of imagination, the intellectual grasp and the insistent logical process of reasoning of that people. Well may they pride themselves on his disinterested tenacity of purpose, his never-ceasing labor, and his grand triumph in the cause of humanity. And well may we join with Frenchmen and the World in united expression of gratitude that he lived to make the World better. The present universal celebration of the centenary of Pasteur's birth is most fitting.

“I greatly regret that I cannot accept your invitation to take a personal part in your tribute at Philadelphia to this friend of man.”

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HON. WOODROW WILSON

Former President Woodrow Wilson writes:

"I heartily wish that I might have the privilege of being personally present on December twenty-seventh at the celebration of the birthday of Louis Pasteur. Since I cannot be I take the means of this letter to express to you, and through you to those who will participate in the celebration, the tribute which I can with genuine enthusiasm pay to the great man of France who undoubtedly contributed as much to the physical welfare and betterment of mankind as any worker in the great realm of science has ever contributed.

"My knowledge of the problems and methods of the great field of science in which Pasteur worked is not sufficiently intimate to entitle me to attempt a critical estimate of his achievement, but I can see that it is his immortal distinction that he not only broadened the thought and enlightened the practice of the great medical profession in the treatment of certain diseases, but also erected barriers against all disease, and so conferred an inestimable benefit upon mankind. He deserves our most grateful praise and is undoubtedly entitled to stand very high indeed in the roll of honor in which those are entitled to have their names inscribed who have worked with beneficent intelligence for the good of their fellow men.

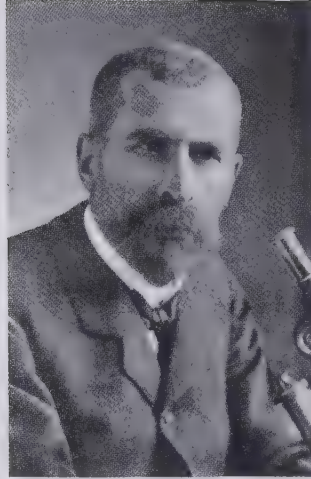
"I join again with all my heart in the acclaim which must greet his name and declare his fame."



SIR AUCKLAND GEDDES, British Ambassador

Sir Auckland Geddes, British Ambassador, writes:

“I am sorry that I cannot be with you to honor the great name of Pasteur. His contributions to knowledge were epoch making. Contribution and knowledge confer undying fame on him who makes them. Generation by generation knowledge has to be renewed by observation and experiment, lest it grow stale and unprofitable. At the most the name of a man, who is the winner of new knowledge and nothing more, is remembered by the world as the root from which new works are derived. Pasteur was far more than a scientific discoverer of the first rank. His was a great soul, which was and is an active force in the lives of men of science. His lovable character, his frank and kindly simplicity are examples, to those who have won fame through original research, to those who stand at the threshold of a scientific career, if they will but listen. His voice still speaks wise words of council. Each of these would do well to have inscribed, so that it would come daily before his eyes, this sentence from the master’s inaugural Address at Lille—‘In the field of observation, chance only favors those who are prepared.’ It is the simplicity, the kindness, the mellow wisdom of Pasteur that makes the great discoverer’s personality immortal.”



DR. PIERRE PAUL EMILE ROUX
Director de L'Institut Pasteur, Paris.

“Rien ne peut toucher davantage l'Institut Pasteur que l'hommage rendu par collègues américains à mémoire Pasteur Philadelphie. Vous adressons cordiaux remerciements pour tous ceux associés avec vous pour cette célébration.”—Roux and Calmette.

“Nothing can touch the Pasteur Institute more than the homage rendered by your American Colleagues to the memory of Pasteur in Philadelphia. We address you our cordial thanks, for all those associated with you for this celebration.”

—Roux and Calmette.



DR. PASTEUR VALLERY RADOT

“Famille de Pasteur profondément émue par hommage de la grande nation américaine à Pasteur; s’associe de tout coeur à cérémonie Philadelphie aux Etats-Unis, pays d’enthousiasme et de tous sentiments généreux. Aï vu année passée culte qu’on a pour Pasteur; en cette date anniversaire ma pensée va vers vous.”—Pasteur Valléry Radot.

“The family of Pasteur is deeply touched by the homage which the Great American nation renders to Pasteur. The family associates itself cordially with the ceremony in Philadelphia and the United States, the country of enthusiasm and all noble sentiments. I saw last year the reverence which you have for Pasteur during his anniversary. My thoughts are with you.”—Pasteur Vallery Radot.

And now, having listened to these inspiring, precious messages, let us go hence, thanking God that Louis Pasteur was born.



REV. FLOYD W. TOMKINS, S. T. D.

The Evening Celebration

At the Bellevue-Stratford Hotel, Philadelphia, Pa.

Introduction of toastmaster by Dr. William Duffield Robinson.

We are here tonight to celebrate the centenary of one who has more than any other by his achievements benefited the human and animal creation, Pasteur.

As Chairman of the General Committee of the National Pasteur Centenary Celebration, it becomes my pleasure and privilege to introduce as Toastmaster of the evening one who has had the unique experience of having lived for weeks in the family of, as well as having worked for months in the laboratory of, Pasteur, a surgeon internationally known and honored, Dr. Ernest Laplace.

The Divine Invocation was pronounced by Rev. Floyd W. Tomkins, S. T. D.

DIVINE INVOCATION

O Lord our God, infinite in wisdom, we thank Thee that Thou hast honored men by calling them to seek Thy truth and to learn of Thee how to heal human agony and how to ease pain. We praise Thee for the noble men who have brought health and strength to multitudes, and so especially for Thy servant whose life and work we gratefully remember tonight. Finite and feeble though men may be of themselves, by Thy gracious love Thou hast given of Thine own power that they might serve Thee in serving their fellow men. We thank Thee for this, Thine unceasing care and Thine actual revelation of truth.

Give grace, we pray Thee, to the brave men who have denied themselves that they might serve suffering humanity; and bless them in the days to come, that they too, as did those who have gone before them, may bring ever higher wisdom, and through wisdom, comfort to this generation of men. And while they follow the Master in healing and blessing, grant them strength and skill, and above all else, the consciousness that Thou art with them to guide and rule. And to Thee will we give the praise and honor, now and forevermore.



DR. ETIENNE BURNET

Addresses of the Evening

THE TOASTMASTER: Your Excellency, Ladies and Gentlemen:

I am not unmindful of the fact that the privilege of presiding over this magnificent banquet was awarded to me, not through any special merit of my own, but by the beneficence and good-will which my friends have felt knowing that I had enjoyed the inestimable privilege of having sat at the feet of the greatest of all masters, Pasteur. I was daily within the shadow of his marvelous personality. It was befitting that this great occasion should have some connecting link between the great-good-will of Philadelphia and the man whom they intended to honor. I have, therefore, the privilege of introducing to you a man who is imbued with the spirit of Pasteur; a scientist of the purest type, who has himself lived over fourteen years in the Pasteur Institute, and now conducts this magnificent work in a French possession, in Tunis. My privilege and honor, therefore, is to present to you Doctor Burnet, the official representative of the French Government, delegated to us to help us honor Pasteur in America on the occasion of the centenary of his birth.

Address of Dr. Etienne Burnet

sous-Directeur de l'Institut Pasteur de Tunis

Mr. President, Ladies and Gentlemen: I cannot now but express my deep regrets to you: only the power of the sea was able to prevent me from enjoying the great honor of being among you to-day.

And now, what can be said of Pasteur? All was already most excellently expressed this afternoon.

You will allow me, however, to dwell on two points that seem to me to be of special importance to-day:

First, to see in Pasteur a master of what may be called scientific idealism;

Secondly, to appreciate what I venture to name his human-social value.

I believe that, were some Emerson to add a savant to the series of his representative men, he would choose Pasteur, not only as a man of genius, but as the type of what may be called *scientific idealism*.

I am not only thinking of the private virtues, both domestic and social, which it is desirable to find in every man, even in the savant,—above all in the savant, Pasteur would say,—and which are not sufficient by themselves to make a great man.

What I mean is the attitude of the savant, as a man, before the great problems of human life, that particular wisdom that enables him to be rigorously a scientist, and, at the same time, not to let his soul wither, but to open it to generous feelings for lack of which human life would shrivel.

As a scientist, Pasteur admitted of nothing but facts and experience:

“The experimental method ought to be free from any metaphysical speculation.”

Listen to what he said on the occasion of the polemic of so-called spontaneous generation:

“Religion, philosophy, atheism, materialism, spiritualism are quite out of the question here. I shall even go so far as saying: As a scientist, I don't care about these. Inquiries about the primary cause are beyond the scope of science. The

latter acknowledges but what it can demonstrate, that is, facts, secondary causes, phenomena."

This is the attitude of every positive mind. It was Claude Bernard's attitude. Outside and above science, he and Pasteur professed the belief that pleased them; Pasteur, a more religious soul; Claude Bernard, most probably, a more materialistic one. Never did their creeds interfere with their experiments.

But if, to take up again Pasteur's antithesis, the man of feeling ought not to influence the laboratory man, he, in fact, in any high-minded scientist, cannot help doing so, and exerting an influence of another kind, as a stimulant, as a source of energy.

The savant must have an ideal.

He cannot possibly minister to the evil powers. He cannot possibly pay any worship but to self-devotion, and peace among men, and freedom. Bearing this in mind, we shall piously receive the lesson of Pasteur's life.

One could make up a whole booklet, a real golden book, with the words by which Pasteur expressed his scientific idealism. Here are some of them:

"The cultivation of sciences in their highest expression is perhaps even more necessary to the moral condition of a nation than to its material prosperity."

"The labors of those addicted to things of the mind, in every department, raise the moral sense. Thanks to them, God's notion itself is spread abroad and exalted."

"The mind is leader in the world. Still, let us not forget that the way of great efforts is more often than not that of great sacrifices."

Rabelais, the greatest writer of the French Renaissance, that age when man was yearning for universal knowledge, once said:

"Science without conscience is but the ruin of the Soul."

For Pasteur, science must not bear obedience to any master, not even to conscience. But it is inspired by conscience.

We in Europe often speak, referring to that bounteousness with which, in America, acquired riches are made to serve great concerns of material and moral utility, of your business idealism. Pasteur would have also met with scientific idealism among you. Never has the world, as we all know, had such need of it. In an age when the technical toil of production is forced upon every man, life would get dull and barbarous, did not man at the same time silently cultivate within himself moral inclinations and generous feelings. Society will not be habitable unless we are idealistic technicians.

Secondly, the commemoration of Pasteur's birth must be an international festival of Science and Peace.

Pasteur, as we know, loved his country passionately. But who would dare suggest his patriotism was not a pacific and humanitarian one? We do not know of any utterance of his in which he separated his country's cause from that of mankind. Let us recall his speech at the Congress of sericulturists in Milan (1876):

"Science has no homeland, because learning is mankind's patrimony, the torch that enlightens the world. Science ought to be the highest embodiment of one's country, as, of all nations, that one will ever be the foremost that stands foremost by the works of the thought and the intelligence. I drink to the pacific contest of Science."

In 1871 he sent back the doctor's diploma that had been granted him by the German University of Bonn. He sent it back, "not without protesting (such are the very words of his letter) his profound respect towards the Dean and all the illustrious professors who signed it." But why should one not quote, as well as this fact, the post scriptum of his letter to the dean of Bonn, Dr. Naumann:

“And now, Sir, when I read over again your letter and mine, I feel deeply grieved that men who, like you and me, have devoted their lives to the search for truth and to the progress of the human mind, should talk to each other in that way.”

Those lines betray such sadness that they, more surely than anything else, convey, under those circumstances, the inmost thought of the man.

And, to wind up, on the day of his jubilee, in 1892, on the day when, glorified by the whole world, he utters his supreme thought, these are his words:

“You, delegates from foreign nations, who have come such a long way to give France a token of sympathy, you bring me the most profound joy that can be felt by a man who firmly believes that Science and Peace will triumph over ignorance and war, that the nations will come to an understanding with a view not to destroying, but to edifying, and that the future will belong to those who have done most in behalf of suffering humanity.”

Ladies and Gentlemen, one hundred years ago, Europe was, as it is to-day, on the morrow of great wars. Pasteur's father had been campaigning both in Spain and in France. We cannot help thinking that some chance bullet would have been enough to prevent Pasteur from being born.

To-day, when we think of the fifteen millions of men who have been killed in this world war, we are entitled to say: How many, among those who died, would have done something useful for mankind? How many bright and generous geniuses the war has destroyed, or prevented from being born?

Therefore, Pasteur verily teaches us to believe and wish to our last that ignorance and war be put down by Science and Peace.



DR. ROBERT ABBE



THE TOASTMASTER: With all his greatness, Pasteur was a man. Genius need in no way impair the human side of the individual. As a boy, he was a mere boy, not showing any special aptitude in his studies, and even in his favorite study chemistry, in which he was destined to become immortal, he reached but the average proficiency. Focussed and concentrated effort, based on perseverance and honesty of purpose, were his chief characteristics. How he was thus led to become the greatest benefactor of humanity will be shown by Dr. Robert Abbe, of New York, whom it is my pleasure to introduce to you.

Address of Dr. Robert Abbe

New York City

“PASTEUR THE MAN”

Dr. Laplace, Ambassador Jusserand, Dr. Burnet and Friends:

The subject is very sympathetic to all of us, as to the world, to-day.

If we take a little from the philosophy of Don Quixote, who said “No man is greater than another, if he does not do more than another man does,” we see that Pasteur towered above all the scientists of this century. He did more than any other man has done, and to-day, on the four winds of the earth, there is borne to us the fragrance of incense burning on a new altar, dedicated, not to science alone, but to Science and Religion; the altar of Science and Religion combined, perhaps for the first time in the history of the world, embodied in him.

It would be difficult to invent a new type of man. All men are the resultant of forces; the combination of parentage, of character, and of the circumstances of their lives. In viewing Pasteur, we see that he had in his parentage a remarkable tendency to make a great man, although many of his neighbors had perhaps somewhat the same parentage. His father was a man of simple life. We speak of an humble life. That does not apply to the class of person in France whom his father represented. He was a man of great industry. For two or three generations they had been tanners of leather, when tanning was a fine art. He was proud of his work. He was patriotic. He fought under Napoleon and was decorated on the field of battle for bravery with the Cross of the Legion of Honor.

When Napoleon was crushed and proud France humbled, he returned, like all the remnants of the army, to the tannery, but proud still, with that pride which dominates the class of the bourgeois; great men en masse in France, they compose the spirit of France which is ever alive and ever dominated by great patriotism. The father led the simplest life, but was proud. He was proud of his boy, born soon afterwards, and made him his constant companion. Pasteur writes afterwards that this dear companionship of his revered father kept him from bad company. That was the beginning of a beautiful life. It meant a great deal in his after life.

The father poured out his soul to the young boy as they walked the fields on Sunday afternoon or went visiting the other neighbors, and there, in that little country town, he grew up with no evidence of genius, simply a boy, fond of fishing, fond of the pleasures of a boy's life, always going about in the study of nature, loving to read, loving art, and, curious enough, at the age of thirteen he produced one of the most perfect pictures,

done in crayon, of his mother, which anyone can see in the libraries. Large reproductions are now issued in folio, of which there are about twenty examples, ranging from the age of thirteen to the age of fifteen or sixteen—for afterwards he was devoted to his books—and they show a remarkable characteristic that dominated his life, an exactness of detail, a study of character, a study of the little lines of the face, of every particular thing, the eyes, almost pre-Raphaelite in perfection. Of these there are about twenty extant which represent the character of his neighbors, the mayor of the town, the lawyers of the town, the dear old nun, the young people of his neighborhood, and above all his devoted boy friend Chapuis. No one can think too much of the importance of one dear companion through life, as Chapuis was to Pasteur. Their names should always be linked together—a boy of the same age, with a soul, a soul like his. He afterwards, in his later life, became the Dean of the Faculty of Dijon, but throughout life and until the very day of the death of Pasteur, Chapuis was his companion. They poured out their souls to each other and they modified each others lives; and that is an incident in every boy's life which it is important to cultivate—the companionship of an equally fine type of mind.

Fortunately, because his monumental works were known while he lived, we have all the details of Pasteur's life, in a biography by one whom he regarded as his own child, Vallery-Radot, his son-in-law. This biography should not be left unnoticed. It should be read by every boy, by every grown person. It is full of beauty, full of lessons, full of thought, full of meaning to the life of everyone. Who can say how many thousands of young men have been brought to their knees by it to register a vow to emulate Pasteur in his life and habits and thought and work?

His schoolboy days were soon over. In the local schools he exhausted all the teachers could tell him, and at twenty he was ready to go to the Ecole Normale, the University of Paris. There he went without a special scientific training. He had taken a degree in letters. But immediately he was fascinated by the brilliancy of the lectures in the University, especially the chemical lectures. Professor Dumas fascinated him. The study of crystals, of which Dumas was a master, fascinated him so that he became a part of the professor's entourage, and was welcomed in his laboratory to investigate further in the study of crystallography, so that he very soon distanced even Professor Dumas himself in solving the mysteries of the formation of crystals, and on that he wrote his thesis.

Then his character as a scientist established itself, a pure scientist, for pure science had taken hold upon his very soul. In the next year or two of his life he was offered a professorship of chemistry, as has been told you, at Strasbourg, and here, as that kindly English writer, Paget, says, "Science welcomed him at the door step and love met him on the threshold," and he formed the companionship of a woman who was his helpmeet and devoted wife for the rest of his life. One of the dearest pictures we have of him is in his garden after he was paralyzed, his wife taking the notes for him—for he could not write—on his studies on the silkworm.

After seven years at Strasbourg he was sent to Lille, to establish a scientific institute, which the Government needed there because it was a growing industrial center. He did not like the idea. To toil in the fields of pure science was his desire; but his love of country led him to accept that wonderful position which he accepted, and in after life he wrote, "Chance comes to the mind that is prepared"—a very deep thought, applying to the life of everyone.

His study of crystallography was the basis of his scientific love,. He loved crystals as he loved his life, and through all his life, although he tried to keep it up, he had to suppress it to the patriotic call of his country.

He found himself in the wine country. No one could have known crystallography

as he did, and here, when the country called upon him to improve the wine industry, which was then decadent, he studied the tartar in the wine casks, and in that study of the fermentation processes which caused it, he made the first great discovery of the bacterial cause of fermentation and the creation of marvelous crystals. No one else could have done that. Chance came to the mind that was prepared.

A short service in that field and his country called him—because of his having already conquered one decadent industry—to investigate the silk industry in the south of France. He went, not wishing to, but told by his master that it was his duty to go. “Why,” he said, “I have never known anything about it. How can I?” There was a problem. He took it up and with that indefatigable working power he was, in a year or two, deeply involved in it. It took him five years to solve that mystery, but he did it. The first year saw him, in young middle life, at the age of forty-six, suddenly stricken with paralysis of the left side of his body. His life was despaired of. His country was in mourning. Scientists gathered about, rivaling each other in the sickroom in the nursing and in the watching at night. The Emperor sent daily to get a gleam of hope that he might be restored to the service of his country. Finally he was a little restored. In three months he was sitting in a sunny garden; in six months he was again directing his laboratory work. In one year he was taking part in the active discussions, dragging his paralyzed limb—to the platform to combat all the errors of science and to aid the discovery of truth so far as he could do it.

His life might be divided—as Dr. Laplace has said the studies of centuries have been divided, by—before and after Pasteur—his life might be divided into two parts, before and after paralysis. Before that he had made one discovery, that of the bacterial origin of fermentation. After that came all the great discoveries.

A noble soul in our own country, stricken in a like manner, is gradually coming back to health and perhaps to solve the riddles that trouble the world. Perhaps, having discovered the microbe of war, we may see the further discovery of the microbe of peace and the inoculation that will check the malady of the world.

One of the most interesting phases of his life, now that we are speaking of Pasteur the Man, was his contempt for wealth. When once the Emperor and the Empress gave him a great reception, the Emperor expressed surprise that he had not converted his great knowledge into legitimate sources of wealth. Pasteur said, in his simple way, that in France scientists considered it beneath them to do so. In his laboratories and in his classroom he was merciless in his condemnation of those students who thought to turn a discovery into a means of acquiring money.

Our own great American, Joseph Choate, said in the latter years of his life, “No man can be truly great who has not a supreme contempt for wealth.” Pasteur’s life demonstrated that. His laboratory was always wherever he could get a room, a garret, or a cold cellar, such as they have in France, warmed only by enthusiasm. But his discoveries were made in spite of adverse circumstances, because of the qualities of his mind and the qualities of his heart.

Of his mind, we see that he had the power of concentration. He had the love of truth. He had a contempt for the philosopher who sat at his desk and evolved theories and made statements that could be controverted, perhaps, while in the laboratory truth was found from facts, facts that were incontrovertible when he once had assembled them, and that was the secret of his whole life—tremendous working power.

Even when he was a boy he wrote back to his little sisters at home from the school that “once you get the habit of work, you cannot live without it.” That was the keynote of his life.

There is a larger world that owes to Pasteur a great debt, the world of religion.

That has been hinted at, but it was a fundamental part of his life, never conspicuous, but always open to anyone to read.

Madame Curie narrates that his colleague, her husband, asked Pasteur once how he reconciled his knowledge with his religion. "Oh," he said, "that is simple enough. Here I place all the knowledge that anyone has, and here"—stretching his hands wide apart—"all the mysteries that are unknown, but that will be known by us all. There I place my faith."

The time of his early life was one permeated with agnosticism and infidelity and disbelief in the universities. There was a cult credited with pride of mind and conceit of intellect. He had to face that. The chilling ridicule of Voltaire and his school, discrediting the All-Seeing Eye and the All-Hearing Ear and the Compassionate Spirit, which even the pagan regards as a great spirit, was to him nothing. If he could ultimately work out facts, he could leave all that to itself.

His life answers the great question of to-day, does modern education tend to a higher knowledge of the Creator? Pasteur's life answers that question.

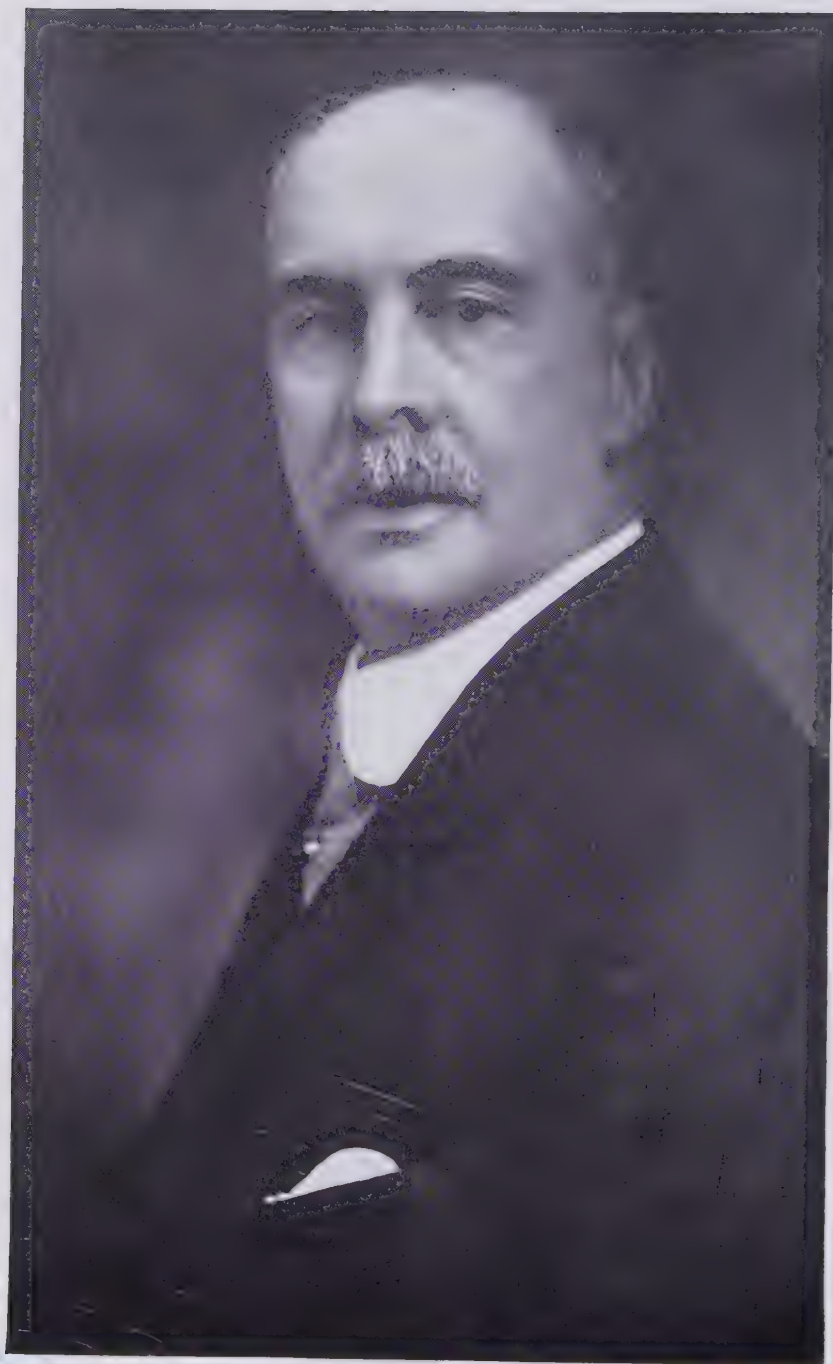
Even to-day your young sons can say, "How about my little radio, by which I speak to my father thousands of miles away and he answers me? Or the X-ray machine which my teacher shows me in school and proves to me that even stone walls can be seen through and nothing is secret in the four walls of my own room?"

Modern education does lead to a higher knowledge of the Creator.

It is not wonderful that in France everything pertaining to Pasteur should be sacred and that outside of France little can be found that had his touch. In trying recently to get together such things as there might be in this country, we have been able to find only three things. One was given to your own city, to the oldest medical society of our country, the College of Physicians, by the Pasteur Institute through Professors Roux and Calmette two years ago, and brought to your city by Dr. Keen, after it had been solicited, to do honor to our country in having something which they could spare, because they could spare almost nothing. But they did spare this beautiful thing, a model of a crystal made by Pasteur in his early life and used by him, labeled with his own pen and illustrating the wonderful study of crystallography which he was demonstrating to the world; this one thing, which bears the fingerprints of Pasteur himself and will always repose in your cabinet as something to give stimulus to the emulation of such a great man. It represents pure science.

The second thing that we found was from Boston, what you might call a subsidiary medical center. It is a flask given by Pasteur to one of the professors, a student also with Laplace in his laboratory, a glass flask which was given to him to use for his demonstrations of fermentation. It represents that wonderful period of bacteriological study in his life which has led to such fruitful results.

The third object has but just come to our country. It has been given by his grandson, Pasteur Vallery-Radot, to another great scientist of our country, Alexis Carrel, a distinguished scientist, ardent in research, as was Pasteur, and of a spiritual life searching with the same spirit of hope as Pasteur. It is a simple thing, and the ordinary passerby would smile to see a plain porcelain door knob lying on a cushion. But it represents his home, and if you look at it, contemplate it as you would gaze into a crystal sphere, you will see before you rising a vision of science, represented by Pasteur, with his hand opening a little way a door, through which streams the light upon a distracted and sorrowing world—a world of human and animal life from which the chains of disease and misery have been lifted—and through that open door they get a glimpse of another world, full of mystery and beauty and compassion.



DR. LEWIS S. McMURTRIE, LL.D.

THE TOASTMASTER: Surgery was the first practical beneficiary of Pasteur's proof that spontaneous generation did not exist. His experiments pointed directly to the similarity of putrefaction in wounds with putrefaction found in cesspools and elsewhere. Lister recognized the principle, applied it to surgery and began the new era of antiseptic surgery. What this has meant to humanity will be told us presently by Dr. Lewis S. McMurtrie, of Louisville, Kentucky, whom it is my distinguished honor to present to you.

Address of Dr. Lewis S. McMurtrie, LL.D.

Professor of Abdominal Surgery and Gynecology, University of Louisville, Louisville, Ky.

"PASTEUR AND SURGERY"

Mr. Toastmaster, Ladies and Gentlemen: I know you have all been charmed by the admirable and beautiful word picture that Dr. Abbe drew for you of the personal character of this great genius of the French nation who has made the entire world his debtor and in whose honor we are assembled here this evening.

This afternoon at the Academy of Music men of national distinction have paid tribute to his memory by relating the various avenues along which his great genius played in working out his problems, the beneficent solutions of which we of the present generation are to enjoy.

What I will speak to you of was treated in a masterly manner this afternoon by one of your most distinguished citizens, Professor Deaver, and I have an idea that it will appeal to you more personally and more directly than any other of these great achievements of Louis Pasteur. Yet it is but one of the by-products of that seething brain of one of the greatest geniuses the world has ever known.

The Toastmaster, a pupil of Pasteur, has told you that Pasteur was not a doctor and he was not a surgeon. Professor Deaver stated this afternoon—I imagined with a little suggestion in his voice—that he had never written a prescription. And yet he revolutionized all the medical sciences, and this was just a by-product from his laboratory which was taken up by others, and there is not in this audience to-night a single individual who is not, either directly or indirectly, indebted to this great genius for some of the greatest blessings that have come into their homes.

I am asked to speak to you about Pasteur in his relation to surgery.

The Science and Art of Surgery of the present day are based upon knowledge accumulated through centuries of patient study and toilsome investigation by many devotees. There have been periods of great achievement by master minds; of advance and retrogression and further advance, until to-day are realized the most optimistic ideals of ancient times.

In the progress of surgical knowledge men of outstanding genius have from time to time made such notable discoveries that successive eras have been established by their achievements. Such were the times of Hippocrates and Galen, founders; fifteen centuries later came Vesalius and Pare, the anatomic era; then Haller, Harvey and Hunter, the physiologic era; and in the nineteenth century came Morton with anesthesia and soon afterward Pasteur and Lister inaugurated the antiseptic era. So recently as in the days of Hunter a surgical operation was considered a last resource, that great surgeon

declaring that "in the main an operation is a reflection on the healing art, a tacit acknowledgment of the insufficiency of our resources."

When anesthesia by ether and chloroform was discovered an impetus was given to surgery hitherto unequalled. Previously a major surgical operation was a tragedy. The screams and cries of the restrained patient were heart-rending to all attendants including the surgeon. But after pain was eliminated by anesthesia, there remained another tragedy even more to be feared. It was the burden and despair of all hospitals and private practice, military surgery and midwifery in every country for centuries. Septicemia, pyemia, erysipelas and hospital gangrene were conspicuous and persistent among the daily tasks of the best operative surgeons. According to the older statisticians as high as 80 per cent of major surgical cases in the great hospitals died from infection, and only a small number of the remaining 20 per cent healed by primary union. Such was surgery within the memory of men now living.

In 1865 Joseph Lister, an Englishman by birth and education, a post-graduate student and assistant to Syme in Edinburgh, had been installed as Professor of Surgery in the University of Glasgow. He was thirty-eight years old, a skilled operator and qualified teacher of surgery. Although a clinician, he was from early pupilage skilled in the use of the microscope, and devoted much time to histology. He had made elaborate studies on the nature of Inflammation and contributed a paper on that subject to the Royal Society. He had made investigations upon the Coagulation of the Blood, showing a marked capacity for painstaking scientific research. These scientific studies in great part were carried on with the aid of animal experimentation.

For years Lister had chafed under the fateful restrictions of surgical practice already described, and was continually indulging the hope of finding some means of overcoming infection of wounds. He tells us that he was profoundly impressed with a clinical fact observed daily in his wards regarding the difference in behavior of injuries according to whether the skin is involved or not. For example, if the bones of the leg are broken and the skin remains intact, the surgeon applies the necessary apparatus without any other anxiety than that of maintaining the fragments in place, although the injury to the bones and soft parts may be severe. "If, on the other hand," he said, "a wound of the skin were present communicating with the broken bones, although the damage might be in other respects comparatively slight, the compound fracture, as it is termed, is one of the most dangerous accidents possible." He then asks: "What is the cause of this astonishing difference?" Replying to his own question, he answers: "It is clearly in some way due to exposure of the injured parts to the external world." And further he says: "I had done my best to mitigate infection by scrupulous ordinary cleanliness and the use of various deodorant lotions." At that time the teaching of Liebig that atmospheric oxygen was the primary cause of infection was generally accepted. This was the way in which the great problem of infection, inflammation and septicemia was formulated in Lister's mind at the outset of his investigations.

About this time Louis Pasteur made known as a result of his elaborate studies that fermentation (and putrefaction) are caused by micro-organisms growing in the fermentable substance. Lister at once was impressed by the similarity of the process of wound infection, wherein the blood of the wound undergoes putrefactive changes. He visited Pasteur in Paris, and was received in that simple and cordial spirit usually found with the truly great. Upon his return from Pasteur, his problem as stated was modified and simplified, in Lister's words as follows: "If the wound could be treated with some substance which, without doing serious mischief to the human tissues, would kill the microbes already contained in it, and prevent the future access of others in the living

state, putrefaction might be prevented, however freely the air with its oxygen might enter."

Here we have the very essence of the principles of modern antiseptic surgery, and starting with this firm conviction Lister entered upon the prolonged and difficult task of proving it, demonstrating it to the world, and by overcoming the opposition inevitably encountered in such a revolution, establishing an entirely new era in surgery. In March, 1865, he made his start with a case of compound fracture, which lesion he had so long in mind. As a germicide he chose carbolic acid. His first case proved a failure. In August of the same year he treated his second case and was successful. Thus in 1865 began those years crowded with labor and experimental investigation with dressings, ligatures, drainage and other procedures essential to carrying out the principles of antiseptic surgery. Pasteur has inducted him into a new and invisible world, and he must construct a road hitherto untrod by any human being.

From time to time technical changes were made, and gradually superfluous details were eliminated. As knowledge increased simplicity was substituted for complicated methods. Needless confusion was wrought by prolonged discussions on asepsis and antiseptis, on the comparative germicidal properties of various chemical agents, but throughout all Lister sought to apply in the simplest and safest and surest way the principles supplied by Pasteur. And that is the essential basis of the surgery of the present time.

The occasion will not permit even an outline of the labor, the prodigious labor of making out by clinical application and laboratory investigation the many problems which complicated and obscured the employment of the essential principles of the new system of wound-treatment; nor can I do more than mention the criticism, hostility and, to a certain degree, ostracism, visited upon one who moved resolutely toward establishing principles which would upset the existing order of things. It required twenty years of incessant labor and persistence to win victory; to induce the acceptance and adoption of the antiseptic system in surgery throughout the civilized world. It is one of the greatest achievements of any man in any age of the world's history. Thousands of lives and untold suffering are saved every year as the result of this life of labor.

Pasteur and Lister, these two great masters of science, have given the world a lesson worthy of emulation in their personal relations. Writing from Edinburgh in 1874 to Pasteur, Lister says: "Allow me to take this opportunity to tender you my most cordial thanks for having by your brilliant researches demonstrated to me the truth of the germ theory of putrefaction, and thus furnished me with the principle upon which alone the antiseptic system can be carried out."

On the 27th of December, 1892—thirty years ago this day—Pasteur's seventieth birthday was celebrated in the great theatre of the Sorbonne. In that brilliant assemblage of statesmen, scientists and scholars, the homage of medicine and surgery was offered by Lord Lister. A writer who was present states that Pasteur arose and embraced Lister, showing to the world "that brotherhood of science laboring to alleviate the sorrows of humanity."

Emerson tells us that "great men exist that there may be other great men." This precept is distinctly applicable to Pasteur's discoveries in relation to surgery. It is most fortunate that this task was first assumed by a surgeon so eminently qualified by temperament and training as Joseph Lister. At the time of Pasteur's investigations the leaders in surgery were following the well-worn path of hopeless effort in trying to solve intricate problems of pathology by observations limited to the most complex phenomena of animal life. In Pasteur for the first time came one profoundly versed in chemistry and physics, and with absolute confidence in the applicability of these sciences

to biological and medical problems. Discarding the teaching of Liebig as to the role of atmospheric air in wound infection, and recognizing the potential agency of micro-organisms as shown by Pasteur, surgery's most vital problem was solved.

It was imperative that the application of principles so fundamental and essential to all vital processes, both in vegetables and animals, should be the work of many minds and hands. This work has become part of daily practice in all departments of medical science, part of the routine of every hospital, of every laboratory. There is no nation on earth which is not happier and richer as a direct result of Pasteur's life-work. He started a series of beneficent influences which will continue in widening circles through all the ages to come. Is not this to be immortal?

Pasteur is one of the glories of France. And how he loved France! That superb nation has contributed generously great names and great achievements to science, to art, to literature and everything which goes to make our civilization. In that galaxy of statesmen, soldiers, savants, scientists, authors and artisans, which commands admiration for the French people everywhere, there is no one whom nature endowed with such transcendent gifts as Louis Pasteur.



DR. HOBART A. HARE, LL.D.

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THE TOASTMASTER: Since surgery plays the most evident part in medicine, it was natural that surgery should reap the first fruits of Pasteur's work. However, a greater triumph awaited Pasteur. From the very germs found to be the cause of a disease, Pasteur was destined to discover the prevention and cure of disease. He discovered the attenuation of germs, whereby a mild form of disease is produced protecting the individual from the severer form of the same disease. The marvelous influence of this discovery in therapeutics will be related by my distinguished friend Dr. Hobart A. Hare, Professor of Therapeutics in Jefferson Medical College.

Address of Dr. Hobart A. Hare, LL.D.

Sutherland M. Prevost, Professor of Therapeutics, Materia Medica and Diagnosis,
Jefferson Medical College, Philadelphia

"PASTEUR AND MEDICINE"

When I learned that it would be my task to make a speech to-night, three things came to my mind.

The first thing was an incident that occurred very early in my medical career, when I attended a dinner at which my distinguished friend, Dr. De Schweinitz, was the toastmaster. At that dinner, being somewhat afraid of the effort that I might make, I made the mistake of writing out a speech and trying to learn it by heart. I could not have learned it by heart very well, because I will never forget the fact that when I had taken my seat at the end of my speech, my constant, life-long friend said, "My Heavens"—I think he said My Heavens—"Pop, are you sick?"

And therefore it occurred to me to-night that possibly it would not be wise for me to try to repeat a learned-by-heart speech.

And then another thought came. It was the story that was told about Abraham Lincoln, which is probably apocryphal, as follows, that in describing the speech of one of his political adversaries, who talked a great deal and said very little, without having prepared himself materially, Lincoln said that his adversary "mounted the rostrum, shined his eyes, opened his mouth and left the consequences to God."

I feared that if I did not receive some inspiration at this dinner and attempted to speak as Lincoln's adversary did, someone in the audience might make a remark similar to that of Abraham Lincoln. Therefore, for the first time in my life, I intend at a dinner—and I have spoken at a number of others, perhaps in the style of Abraham Lincoln's adversary—to read what I have to say, hoping to put enough spirit into it to carry to your minds not only the words that you may hear but the thought with which I would like to embellish those words.

To respond to a toast to Pasteur after nine other speakers, not including the toastmaster, have dealt with the same subject in the brief space of a few hours, would be impossible were it not that what has already been said serves to indicate that the theme is inexhaustible.

In dealing with the subject of Pasteur in medicine it is all but impossible to avoid repeating some of the points already so well emphasized, yet, I am bold enough to believe that certain additional facts may be brought forward if the toast reads "Pasteur and Medicine" rather than "Pasteur in Medicine."

The first point deals, of course, with the work which Pasteur did to make medicine more of a science and less empirical. To reveal to us that infectious disease never arises *de novo*, but always from another living organism which has been invaded by a given parasite. By this discovery the whole field of preventive medicine has ceased to be a

desert and becomes a plain fertile beyond description in its result to the human race, for after all for every life that is saved by treatment after disease is implanted, thousands of lives are saved not only from death but from weeks of misery which may only perchance end in recovery. When we recall the fact that the mortality from typhoid fever was at one time 20% and that now its incidence and mortality is almost negligible, and further when we recall that the mortality from this disease in Berlin was at one time one in every nine hundred persons whereas now it is about one in eleven thousand persons, the amount of suffering and death which has been prevented from this one disease is stupendous.

The researches of Pasteur, as Dr. McMurtry has told you, have saved thousands of lives in surgery, and they have also saved millions of lives for medicine, for, as I have pointed out, medicine deals not alone with those who are ill, but with those who may become ill. In India it not infrequently happens that as many persons die in one year from plague as the entire population of the city of Philadelphia as it exists to-day, all of which could be prevented if the fundamental principles laid down by Pasteur could be instituted. Not only this, but Pasteur showed that experiments on animals serve not only by increasing knowledge to protect millions of human beings, but equal millions of other animals from suffering and death.

It is needless to deal with other scourges of humanity, notably diphtheria and tuberculosis. They show almost equal results. Those of us who had to cope with typhoid fever and diphtheria some years ago, know full well how impotent we were and with what agony of mind we saw our best efforts fail when epidemics occurred. Now we can prevent and cure.

This theme has been so well covered by earlier speakers that it is not appropriate to dwell upon it longer. It suffices to state once more that Pasteur laid a foundation for the healing art which will last forever.

But after all, the phase of Pasteur's efforts that I have just passed over is not the only point of importance for us to consider, for Pasteur and his relation to medicine has another aspect. Let me for a moment recall to your mind that from youth to old age he loved truth for truth's sake, that he loved science for its sake, that his pulses throbbed at the first sign that a research was pregnant with truth and discovery, and that he rejoiced not that he had found a way to make a fortune for himself, but a fortune for Knowledge. Mozart and Beethoven never thrilled more with their own music than did the soul of Pasteur as each investigation neared its end, not that he saw and grasped for himself the financial reward of his labor, but because his reward came in the satisfaction of the discovery itself.

Again, if we review the personal life of Pasteur we note his humble origin, his early poverty, and for many years his constant poverty, his bereavements and equally distressing his stroke of paralysis in middle life, from which he thought never to recover, and which threatened death when he was in the full tide of his career. Yet he lived twenty-seven more years becoming greater every decade. For these reasons, even more than his actual discoveries, is his memory to be revered, because he taught us, as few others have succeeded in teaching so well, that faithfulness to a great ideal, that victory over every obstacle must be the goal of every man, if he is to be worth while. The result to-day is that where there was one scientific investigator in the field of medicine in the latter part of the last century, there are to-day several thousand, all imbued at least with what may be called "the soul of research." Lantern bearers, some to fall by the wayside, if they do not truly find this soul, others bearing lanterns, glowing with incandescence as they spread more and more widely over the world, lighting darkest Africa on the one hand, or lighting darkest civilization on the other.

This then is the divine gift handed by the Almighty through the person of Pasteur to the world to-day and to medicine in particular. He gave to those investigators who would take it a soul, or what the Samurai among the Japanese called "Bushido." What is this soul? It is something intangible but real, something of which we are conscious, but cannot feel. It is that thing that Osler in his Ingersoll lecture on Mortality said was the inspiration of the Teresians in distinction from the distraught state of the Laodiceans and Gallionians.

But it is not proper to think that Pasteur was the only man who gave us a chance to grasp the soul of research. Here in our own midst there lived another whose career ran strangely side by side with that of Pasteur, namely, Joseph Leidy. Pasteur was born December 27, 1822, the son of a small tanner; Leidy was born September 9, 1823, the son of a small hatter, and both lived almost the same span of years; both were alike as to their physiognomy and spacious brain cap; both were alike as to their greatness and their power; both struggled with a poverty of cash and both reached the richness of achievement; both taught rudimentary things in order to keep the wolf from the door and both were elected to professorships early and at about the same age. While Pasteur was interested in chemistry and crystallography, Leidy was interested in mineralogy and precious stones; when Pasteur was studying the microscopic parasites of animals and men, Leidy was becoming the greatest living authority on their macroscopic parasites. Pasteur has had an enduring monument erected to him in Paris and Leidy has had a peak in the Rocky Mountains named "Mount Leidy" as a tribute to his work as geologist and paleontologist.

But, while Pasteur and Leidy gave us the soul of research, beyond this their paths separated, for Pasteur's studies enriched science, medicine and commerce, and Leidy's only enriched science itself. And again they differed in one other respect, namely, that Pasteur possessed not only the characteristics of the steadfast investigator but imagination as well, a quality which Leidy largely lacked; and imagination, if properly controlled, often leads one forward by leaps and bounds to a sure achievement; imagination uncurbed is fatal, but controlled, is almost divine. Uncurbed it is embodied in Henry Ford and his Peace Ship filled with Angels of Peace propelled by gasoline, and when curbed by Turner in his paintings.

What then are the gifts that Louis Pasteur left to us?

First, there is no such thing as spontaneous generation, which being interpreted means we can always find a cause for disease in plant life, animal life and human life, if we know how to look for it.

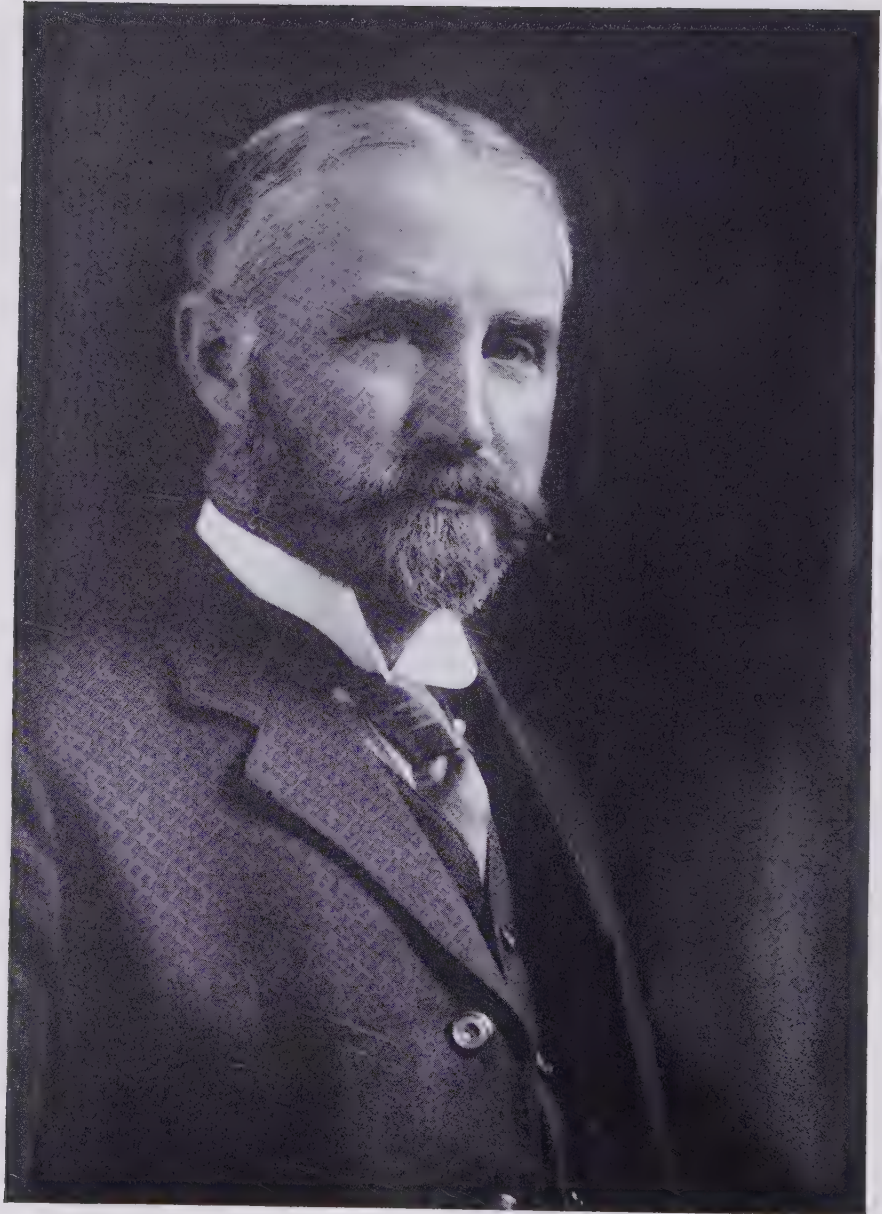
Second, constancy in adhering, in and out of season, to the course laid down, combined with sound judgment exercised when the course should be changed but not arrested.

Third, he gave thousands of men a motif or a soul in that he inspired them to seek and find and conquer all obstacles.

Fourth, he taught us that as we love science so will it love us, and that in this love there comes a peace that passes the ordinary man's understanding.

Last, but not least, he left the precious heritage that to be truly brave is to have courage when courage seems impossible, or, to use the phrase of a recent French writer discussing the World War, the English were not brave on the battle field because they were courageous, but because bravery with them was a habit. Courage on the battle field, great though it be, is not so great as the persistent courage in the lonely hamlet or in the isolated laboratory in the face of pestilence.

Pasteur showed as "invincible a spirit, as sublime a courage, as unwavering a faith, and as knightly an example of self sacrifice as the annals of the human race can disclose."



DR. H. S. PRITCHETT, LL.D.

Address of Dr. H. S. Pritchett, LL.D.

President, Carnegie Foundation, New York

(Read by title in the absence of Dr. Pritchett through illness.)

"PASTEUR AND SCIENCE"

A hundred years ago Europe was fast recovering from the shock of the Napoleonic Wars. Seven years before, the Congress of Vienna, directed by monarchs whom to-day we would call reactionaries, had made a peace which lasted for forty years.

Into this world, seeking to readjust itself after a chaos of war and of revolution, was born, one hundred years ago to-day, Louis Pasteur.

His father, Jean Joseph Pasteur, pursued the modest calling of a tanner, but back of this work-a-day occupation lay a romance of the days of the great Emperor. Pasteur was one of Napoleon's veterans, drawn as a conscript in the Peninsular Campaign of 1812, and serving through to the day when he formed one of that small group of survivors whom Napoleon called "the bravest of the brave." Something of this fire of romance and of achievement the soldier-tanner transmitted to the little son, born at Dôle in the Street of the Tanners, on Friday, December 27, 1822.

Louis Pasteur began his scientific education as a student of drawing, one of the best methods of training for any student of science. No study is more fruitful than that process by which the eye is taught to visualize and to reproduce upon a flat surface the relations of objects in space. By this natural path Pasteur came to study the forms of crystals and then the process of crystallization, and by the most natural steps came slowly but surely from the study of the mechanics of nature into the study of its processes—spontaneous generation, fertilization, the practical problems of the manufacturers of vinegar, of beer, of wine, and in the end to the epoch-making researches on the part played by similar micro-organisms in the diseases of the silkworm, of sheep, of horses, and finally in the diseases of human beings. The culmination came with his greatest triumph—the inoculation against rabies and the establishment of the Pasteur Institute in 1886, in which originated those wonderful researches which, in the hands of himself and his followers, have changed the whole theory of the cure and prevention of disease, which have made possible modern surgery, and finally placed the profession of medicine upon a secure and lasting basis of true science. No other single human life since the beginning of time has contributed so much either to the alleviation of human misery or to the power of the race to enjoy normal, healthy life by the exercise of a reasonable intelligence. He is the outstanding figure of his century and has entered into an immortality destined to grow brighter as the centuries of the future pass, one by one, into the twilight of the past.

Pasteur was characteristically a Frenchman. His severely logical mind, his insatiable thirst for the truth, his impatience of sham, are characteristic of the highest French qualities that have given to the world so many of the spirits that have lighted the way to truth. But his greatness, while characteristically French, transcended nationality, and to-day the world turns to him as a type of leadership as it has never done before, and that at a time when mankind is groping in a wilderness of misery and of confusion compared to which the troubled days in which Pasteur came into the world seem relatively peaceful. What does Pasteur mean to us? What is his significance to the spirit of the world which to-day stands more in need than even the long-suffering bodies of its stricken humanity?

It is not easy to put in a brief paragraph the spiritual lesson of Pasteur's life. It is like trying to epitomize the significance of Abraham Lincoln, almost a contemporary of

Pasteur, but springing from a source more humble and lacking the background of ancestral glories to illuminate it. What is it that differentiates such men as Pasteur and Lincoln from the near-great?

I take it that as humanity looks back over its past and takes cognizance of those forms which tower above all others, we will agree that the greatest are those who have first thought clearly and through such thinking have come into the truth, but who also have loved their kind, and even in their vision of the truth, have had a deep and tender tolerance for human weaknesses. These are the great of the earth, and to this small group Pasteur belongs.

Men who think with clearness and who bring out the right answers to our political and social and ethical problems are not rare. There is a still larger group of those whose emotions are kindly and whose sympathy with human needs, whether of the soul or of the body, is quick to respond, but only too often the thinkers forget the human side and only too often the well-meaning words of those whose sympathies are warm but whose thinking is crooked have led men into the deepest wilderness in which humanity has wandered. Trusting mankind is betrayed more frequently by a fool than by a knave. The leadership which we of to-day desperately need is a leadership which, first of all, thinks straight but which also has a deep devotion to the service of humanity, and most important of all a wise tolerance for its weaknesses.

Our country suffered little from the war. Our hardships are trivial compared to those of the people of France, of Belgium, of Germany, of Russia, or of the rest of Europe, and yet we too, no less than the people who are in the very valley and shadow of want, turn a willing ear to the unthinking emotional leader.

For five and twenty years a large proportion of the people of our free country have been led first into one wilderness and then into another by a political leader who has never had the patience or the intellectual energy to think, but whose claim to leadership is the magic of a ready tongue.

To-day the very institution of government in our country is made more or less insecure by the disposition of men to break up into factions, to follow the call of this or that leader who claims to do the impossible.

We have just seen a body of ardent young soldiers, gathered together in response to the call of national patriotism, organized into a self-seeking political association by unthinking leadership. These young men were full of the spirit of national devotion, they had no intention of organizing to do other than patriotic things, and yet they have been led by leaders who fail to think straight to turn themselves into a political lobby for their own benefit. The legislation they propose is the most demoralizing the country has ever known and its passage was only prevented by a small group of senators who had the courage and patriotism to stand by the president's vote.

Within the past few months, we have seen the ranks of organized labor, officered by leaders who fail to think straight, take the Nation by the throat and insist upon their demands at the price of want and suffering for the great body of citizens.

There has come recently a recrudescence of the notion that men can be made virtuous or temperate by statute, and we witness to-day the effort to impose upon great communities of millions of peoples, against their will, the enforcement of a statute which has nothing to do with morality, which has nothing to do with crime, but expresses merely the moral notions of other communities.

All these efforts fail to take into account the fact that temperament is as great a factor in government as law. This Lincoln understood marvelously well when, in the days before our great civil conflict, he voiced his faith in a mighty governing power but also his conviction that such power is to be used always with great caution, that it must

be slow to compel, that it must be tolerant of human errors, and work like the gradual forces of nature by such steps as human kind can take.

When we try to visualize in one image that which Pasteur means to the men of our day, we like to remember his words in reply to the Dean of the Faculty of Medicine at Bonn, words written in view of his own sharp words spoken under the pain of wounded patriotism. "And now, Mr. Principal," said he, "after reading over both your letter and mine, I sorrow in my heart to think that men who like yourself and myself have spent a life-time in the pursuit of truth and progress should address each other in such a fashion." These are words that to-day angry men in France and in Germany may well remember.

When we try, therefore, to visualize Pasteur's message to the people of our day we are compelled to include in it a conception large enough to embrace both the scientist and the humanitarian, both him who realized the unity, not only of Physics and Chemistry, and Biology, but who realized also the unity of economics and politics and religion. We think of him as one who not only saw the truth, but who was tolerant of those who halted and stumbled in their effort to reach the truth. In these characteristics he reminds us again and again of our own Lincoln, who like him saw the truth and yet also saw that the endeavor to push people into the right way might do a greater wrong than the original error itself. As the greatest of men have united in their own persons ability to think and tolerance of those who stumble, they approach nearer and nearer to the type of that Elder Brother of mankind who was Himself the greatest exemplar of clear thinking and of wise tolerance.

There is nothing so remarkable in the teaching of Jesus Christ as the universality of His message. The truth that He taught to a remote, half-barbarous people applies to all ages and to all places. As far as possible He was removed from the type of the reformer. That which He said was true of all men and of all times, and He never attempted to enforce it by statute or compulsion.

War was, in His day as it is in ours, a source of untold misery, but He never condemned the soldier. On the contrary He said to him, "Live your life, bravely, loyally, devotedly." And He taught those fundamental truths of human life and brotherhood which if they enter into the hearts of men will make war impossible, and this is the only process by which war will ever be made to cease.

Slavery was an evil in Christ's day, which ate at the very heart of civilization, and yet He never began a crusade against slavery. He urged the slave to obey his master, to do his duty patiently and manfully, but He taught that deep love of human kind and of duty to God and men which, finding a lodgment in the hearts of men, would make slavery impossible. And it was the only way by which slavery could be abolished.

Drunkenness was a curse in His time as it is in ours. There were organizations for total abstinence in His day, but He never joined them and, while He condemned drunkenness, He never condemned drinking. On the contrary He used the wine of the country habitually, and although for doing this He was called a wine-bibber and a drunkard He never changed His attitude. He never invoked a statute to make men either temperate or virtuous, but He taught those truths of self-control by God's aid and in God's service which enable a man to master his passion whether it be of drink or of any other temptation, and that is the only way in which the world will ever be made temperate.

As we look back, therefore, at the figure of this great Frenchman of the last century, we see that he combines those qualities which belong to the greatest of mankind. He thought clearly, he was a lover of men, he was tolerant of its weaknesses. He speaks to us to-day both the language of science and of faith. Will humanity, whether in one country or another, groping for help, avail of leadership like this? Will it take the

lesson in such a life? Can it be influenced by such leadership as the life of Pasteur offers?

We must believe that it will, that slowly the views of him who thinks will prevail over the loud promises of the unthinking demagogue, that the quiet tones of him who loves his fellows will prevail against those who think that men can be made to walk in the right path without regard to their human weaknesses and their human wills. More and more we must hope that the time will come when mankind will cease to be crucified not only by its knaves but by its fools, and that spiritually there will come into the troubled present-day world a leadership that thinks, that loves, and is tolerant.

Some years ago there was taken, amongst the children of France, a vote on the question as to who in their judgment was the greatest Frenchman. Three names led all others. They were those of Napoleon, of Victor Hugo and of Pasteur, but the name of Pasteur led all the rest.

“Great captains, with their guns and drums,
Disturb our judgment for the hour,
But at last silence comes;
These all are gone, and, standing like a tower,
Our children shall behold his fame.”

My Personal Impressions of Pasteur

By Ernest Laplace, M. D.

In June, 1885, I was introduced to Pasteur by Professor Cornil at the laboratory Rue d'Ulm. I was willing to do any work for the privilege of being near the man who I felt had already regenerated medicine and surgery through his marvelous researches and discoveries. The work on Hydrophobia had already progressed most successfully and Pasteur was engrossed with its direct application to man. His face stern and thoughtful betrayed the emotions which the successful application of the treatment of hydrophobia produced in him. His power of concentration gave him a severer expression than he really possessed, for when he relaxed in friendly conversation with kindred spirits, he was the gentlest of men. He showed the determination born of long and patient endeavor to seek truth, wherever it was to lead him in science, unmindful of the traditions and usages accepted in medicine. He had surmounted all difficulties which his opponents had placed in his path through the unerring methods created by his genius. As a result he would brook no opposition to his views except they were based on sufficient experimental grounds, for he himself never held an opinion except based on the results of what he called the experimental method. As an example of that is the following episode. A well known American surgeon on visiting Pasteur said in my presence: "Mr. Pasteur, I do not believe that there is such a disease as hydrophobia. I believe it is a form of hysteria and that death comes through fright." Pasteur answered: "My dear sir, you are a doctor and I thank God I am not a doctor, because if I were a doctor I probably would be trained as you have been, and possibly would think as you do. Not being a doctor I have started my work quite independently and have followed it wherever it has taken me based on the experimental method. We therefore cannot argue from the same standpoint. Let the future decide whether I am right or wrong." These words sank very deeply into me and have often guided me on my way. If we, who are the creatures of heredity and environment could only step outside of ourselves and forget the things we know, so as to look at things from a different aspect, what marvels of discovery, as in Pasteur's case, could be brought about?

The work of Pasteur was truthful and independent, ever illuminated by genius, and yet he maintained a humility of spirit and faith in things above our understanding, owing to the still very limited power of the human mind. He did not think that science should interfere with religious belief and the eternal cause of things. "How can it?" he said. "What I know, I know. That is science. And what I do not know and remains to be known I take on faith as a child takes on faith all the knowledge that his father has. As yet none of us can possess but a small amount of this." It is wonderful then that his mind remained unclouded and illumined by the spark from the eternal source of light from which only real knowledge can come.

As all great innovators, Pasteur had his enemies. I myself have heard a learned professor in the large Amphitheatre of the Medical School of Paris, denounce Pasteur as a "Quack Chemist who should be arrested for giving hydrophobia instead of curing it." As a result the inoculations against hydrophobia were performed by Professor Grancher or some graduate in medicine, Pasteur himself not having taken a medical degree.

On the day I obtained my doctorate, I showed Pasteur my certificate. It just happened that some patients had to be inoculated against hydrophobia and the doctor appointed to do so was absent. Pasteur said to me, "My young friend take this syringe and give this injection for me, you have the legal right to-day to do in France that which I have not the right to do." I, who was unworthy of loosening his very shoestrings, was asked to do this act, by the one whom I revered as the greatest of all benefactors of hu-

manity. What irony of fate that so much greatness should be submitted to so much humiliation!

Pasteur was essentially a great thinker. For this he would not endure distraction. He seldom went to places of amusement and believed even in reading as little as possible the writings of others. He asked me once to read a certain article for him, and then to tell him the contents, assuring me that it was not well to read too much. He said it might fill our mind so with the trend of another's thoughts, as to destroy our own initiative and originality. "Better," said he, "to have some one read for you, than to dwell very long on the minute processes of another's mental efforts." This is a thought of much value, to those pursuing a strictly original line of investigation.

On the day I left the laboratory in September, 1886, I obtained from Pasteur, after much solicitation, one of the flasks of veal broth made by him in 1862, used in the final experiments to disprove spontaneous generation. I have now the pleasure of showing it to you as pure as the day it was made. Practically all of modern medicine and surgery is the natural outgrowth of the series of flasks of which this is one. It can therefore be considered as one of the most precious medical relics in the world.

In 1891, the Governor of Pennsylvania commissioned me to go to Berlin and obtain from Koch some "Lymph" which had aroused the enthusiasm of the whole world as a curative agent for Tuberculosis. On my way to Berlin I stopped in Paris to see Pasteur about my mission. He at once expressed to me a great doubt as to the success of this method:—but advised me to return to see him on my way back. When I had explained to him what I had seen in Berlin, and especially the violent reaction following the lymph, he said to me: "This cannot succeed; it will only stir up the tuberculosis process; the action is too violent." Then he added: "But none the less remember what I say to you now—the last word will be spoken by chemistry. How I would like to work much longer, there is so much work left to be done and such a short time to do." These were the last words spoken to me by the Master, as he said farewell. And so I saw for the last time the man who developed the trunk and the roots of that great tree of knowledge, whose branches and fruits constitute the medicine and surgery of to-day.

I wish to thank the City of Philadelphia for providing the funds which have made this Pasteur Centenary Celebration such an eminent success and to tell the audience that a large portrait of Pasteur will be given to each one of you on leaving the hall. As a fruit of the celebration I suggest:

First: That the City of Philadelphia under the guidance of the University of Pennsylvania name a street in Philadelphia after Pasteur.

Second: That a committee be appointed as soon as possible, under the patronage of His Excellency Ambassador Jusserand, to obtain from France a statue of Pasteur to be placed in a prominent part of Philadelphia.

Third: That a Pasteur Institute be founded in Philadelphia based on the same liberal and scientific lines as that in Paris; that it be suitably endowed so as to foster men of genius who are imbued with the lofty spirit of Pasteur; that this Institute be free and independent, governed by a Board of Trustees of highest character.

This would be but a fitting tribute to the immortal Pasteur, for his work has divided the history of Medicine into two grand epochs:—

Before and After Pasteur.

A Monsieur le Docteur Wm. Duffield Robinson, Président of the Pasteur Committee,
Philadelphia, Pa., U. S. A.

Monsieur le Président:-

Notre collègue le Dr. E. BURNET, délégué du Gouvernement Français et de l'Institut Pasteur, nous a fait le récit de la commémoration qui a eu lieu à Philadelphie, sous les auspices du Comité dont vous étiez le Président.

Il nous a communiqué l'impression profonde que lui ont laissée la grandeur et la beauté du cadre, le nombre et la qualité des participants, leur foi dans la science, leur sympathie pour notre pays, leur piété enthousiaste pour la mémoire de Pasteur.

Permettez moi de vous exprimer la gratitude que tous les Membres de l'Institut Pasteur éprouvent pour les hommes éminents qui ont organisé la célébration de ce Centenaire, pour le Corps Médical de Philadelphie, pour la Cité qui tient une si grande place dans l'Histoire de la Liberté et de la Culture Américaine, et d'y joindre pour vous-même, Monsieur le Président, mes sentiments d'estime et de sympathie personnelles.

DR. ROUX.

To Dr. Wm. Duffield Robinson, President of the Pasteur Committee,
Philadelphia, Pa., U. S. A.

Dear Sir:-

Our Colleague, Dr. E. Burnet, delegate of the French Government and of the Pasteur Institute, has given us an account of the celebration that took place in Philadelphia under the auspices of the Committee of which you were the President.

He told us of the profound impression, of the size and beauty of the occasion and likewise the number and quality of the participants; their faith in science; their sympathy for our country and their enthusiastic reverence for the memory of Pasteur.

Allow me to express to you the gratitude which all the members of the Pasteur Institute feel for the eminent men who organized this centenary celebration; for the medical profession of Philadelphia and for the city that holds such a large place in the history of liberty and American culture, and to this I add my profound sentiments of esteem and personal sympathy.

DR. ROUX.

GUESTS

Abbe, Miss H. C.
 Abbe, Dr. Robert
 Anders, Dr. James M.
 Ashhurst, Dr. Astley P. C.
 Aydelotte, Dr. Frank

Babcock, Dr. and Mrs. W. Wayne
 Baker, Dr. George Fales
 Baker, Mr. Joseph H.
 Baldi, Mr. and Mrs. C. C. A.
 Baldi, Dr. and Mrs. Frederic S.
 Baldi, 2d, Mr. Joseph F. M.
 Bassett, Dr. A. E.
 Baugher, Miss Edna Harwood
 Baugher, Mrs. K. Hafer
 Beardsley, Dr. and Mrs. E. J. G.
 Bedell, Dr. Arthur J.
 Behrend, Dr. Moses
 Bell, Jr., Mr. Samuel
 Beltran, Dr. Basil R.
 Belville, Dr. and Mrs. J. Edgar
 Benson, John W.
 Beringer, Mr. George M.
 Biberman, Mr. Herbert J.
 Biberman, Dr. John M.
 Biddle, Dr. J. C.
 Blakiston, Dr. and Mrs. Kenneth M.
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 Bochman, Mr. and Mrs. Charles F.
 Bower, Dr. and Mrs. John O.
 Braisted, Dr. W. C.
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 Brinton, Dr. Ward
 Broomell, Dr. I. Norman
 Brophy, Dr. and Mrs. John A.
 Brown, Rev. Albert G.
 Brown, Jr., Dr. Henry P.
 Brown, Dr. Samuel A.
 Brubaker, Dr. and Mrs. Albert P.
 Brumm, Dr. Seth A.
 Bryant, Mr. Henry G.
 Brylawski, Dr. Edward
 Buckley, Dr. and Mrs. A'bert C.
 Buckman, Dr. Lewis T.
 Burch, Mr. and Mrs. Francis
 Burnet, M. Etienne
 Burr, Dr. Charles W.
 Butler, Mr. and Mrs. Charles Stroud

Cadwalader, Hon. John
 Cadwalader, Miss Sophia
 Cairns, Dr. A. A.
 Campbell, Dr. H. C.
 Campbell, Dr. Wm. J.
 Carmany, Dr. Harry S.
 Carnell, Miss Laura
 Carnett, Dr. J. B.
 Cassidy, Dr. Paul B.
 Casto, Dr. Theodore D.

Chittenden, Dr. Russell H.
 Clark, Mr. John G.
 Clark, Dr. Wm. L.
 Clark, Mrs. Wm. L.
 Clarke, Jr., Dr. and Mrs. J. A.
 Clement, Mr. John Browning
 Cliffe, Mr. W. L.
 Codman, Dr. and Mrs. Chas. A. E.
 Codman, Miss Florence Louise
 Codman, 2nd, Mr. John E.
 Codman, Miss Mary Louise
 Cohen, Dr. Myer Solis
 Collins, Mr. Herman L.
 Conaway, Dr. Walt Ponder
 Cooke, Mr. and Mrs. Morris L.
 Copp, Mr. Owen
 Cresson, Miss Dorothy L.
 Cret, Mr. Paul P.
 Croskey, Dr. John Welsh
 Culp, Dr. John F.
 Cummings, Surgeon General

Daland, Dr. Judson
 Davis, Dr. and Mrs. J. Leslie
 Davis, Dr. Warren B.
 Deaver, Dr. John
 Deaver, Dr. John B.
 Dercum, Dr. and Mrs. Francis X.
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 Dunham, Dr. and Mrs. James

Eiman, Dr. and Mrs. John
 Eisenlohr, Mr. Charles J.
 Ely, Dr. and Mrs. Thos. C.
 Engelhardt, Dr. C. S. Ruth
 Engelhardt, Mr. Carl Olaf
 Ewen, Dr. Warren L.

Faught, Dr. L. Ashley
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 Felton, Mr. and Mrs. Wm. H.
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 Fisher, Mr. Charles Perry
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 Freeman, Dr. and Mrs. Walter J.
 Freese, Dr. Annie E.
 Friedenwald, Dr. Harry
 Friedenwald, Dr. Jonas S.
 Frontz, Dr. Howard C.
 Funk, Dr. and Mrs. David S.
 Furbush, Dr. C. Lincoln

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